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THE AMERICAN COLLEGE AND LIFE[1]

IT is in no wise due to my own choice and moving that I am called upon to take part in this discussion. Just because philosophy calls for so much reflection, I consider it a proper part of a philosophical student's business to keep himself relatively naïve, unreflective and directly practical regarding at least some important portion of his own life's business. Upon certain problems it is my duty to reflect, in as critical a fashion as I may. I do reflect about those problems with a good deal of persistence, and I discourse upon those topics at wearisome length. They are topics of logic, of metaphysics and of general ethical doctrine. In the rest of my life I try to stick to business without much reflection. Such naïveté need not mean, I hope, either carelessness or unfaithfulness. It may mean, and in my case I hope that it does mean, so far as that part of my vocation is concerned, practical absorption in tasks. Now part of my vocation is that of a teacher. And while, as I said, I reflect a great deal upon the metaphysical and other topics concerning which I have to teach, I have never been disposed to reflect much about the practical business of teaching itself. I teach as I can. When I observe that I teach ill, I try to mend my ways. I can not tell much about how I try to mend them. I can not formulate a theory of teaching. When I observe that a student

[1] An address given before the Section of Education at the Baltimore meeting of the American Association for the Advancement of Science.

is inattentive, I try to interest him. When he is wilful, I try to get past his wilfulness as I can. I do not know what, as a teacher, I accomplish. I simply try my best. And I suppose that, for me, with my limitations, such relatively unreflective efforts to do my best are most useful to me as a teacher. And similarly, as to the general conduct of a college, I avoid theories. I attend various faculty meetings, and have a natural and somewhat uncritical fondness for the wisdom of my administrative leaders and colleagues. But I do not understand college administration, especially under modern conditions. I have listened pretty patiently to some long and learned faculty debates upon the problem of college entrance examinations. I have never been able to comprehend the subject. I prefer to reflect upon such straightforward and solid problems as that of the absolute. I leave such airy topics as the reform of the secondary schools to those who know about them. There seem to be many such knowing persons. I hope that together they have wisdom enough to meet the issues of their time. But never, by my own choice, would I venture to take part in the counsels of the wise regarding the theory and the general conduct of what is called the American college. For I know that I am merely a servant of the college, who can do best by holding fast to my own work. Since, however, men much wiser upon this topic than I am have insisted upon my taking part in this debate, I offer my views simply as the personal impressions of a college teacher, who has tried for years to be faithful to his calling, but who has no general theories as to the college. I come here simply as *ein Thor*, who, if I have any sort of insight into my practical tasks as a teacher, or into the value of the American college for life, possess this insight merely as one who am perhaps a very little *durch Liebe erleuchtet*. I am told that testimony is desired here, as well as comprehension. Upon these topics my comprehension is of the slightest. Let me merely offer my testimony.

I may begin the summary of my impressions by relieving you of the notion that I have any right to speak as a representative of a distinctively Harvard point of view. I have tried to serve Harvard as I could for more than a quarter of a century. And my personal love for Harvard and for my work there is indeed at the heart of whatever I can say. But I am a graduate of the University of California. My educational prejudices were first formed under the conditions of far western state university life, and were later modified by study at the Johns Hopkins University. I keep many of my early prejudices still. And they result in this impression, viz., that some of the most important problems of what your title calls the American college will have to be worked out under the conditions of the great state universities. The center of gravity of our future American academic life can not always, can not, I think, very long remain east of the Alleghenies. Through a perfectly natural and inevitable evolution, the state universities of the middle west and of the far west, supported as they are, and will be, by the vast resources of their own communities, and guided by constantly improving educational ideals, will within a generation or two occupy a very nearly central place in the academic life of our country. I do not imagine that the older eastern institutions will fail also to advance rapidly and effectively. But they will in many ways need to undertake functions more closely analogous than their present functions are to those of the state universities. That is, as institutions whose influence

will more and more be felt in the organization of the whole system of public education in their respective provinces, as trainers of our new coming foreign population to the duties of citizenship, as servants of the state, as centers of guidance, both for technical education and for research, the older eastern universities will, like the western state universities, undertake a variety of tasks which they now very unequally recognize and pursue. Hence, as I believe, when we think of the future of the "American college," we should remember that this future is bound up, inseparably, with the future of the American state universities, and with the future of institutions whose functions will be in more and more ways analogous to that of the state universities. It is, therefore, simply useless to try to think of something called "the college" as if its function could be sharply separated from that of very various grades and types, both of technical and of professional schools. I think that the usual disposition of many educational theorists to insist that, for the sake of a dictionary definition of the term college, and for the sake of some historical tradition, such a sharp separation of the functions of "the college" from the technical school on the one hand, and from those of the graduate professional school on the other hand, should be made where it does not at present maintain itself —I think, I say, that this usual disposition is misleading. Look at the state universities and see what the work of "the college" with them always has been. It is a work that in various parts of the same institution may involve training in agriculture, in mining, in classics, in political science, in philosophy, in music and in civil engineering. One may protest as one will that one misuses the term college when one talks of a college of agriculture, and that one ought instead to speak of a technical school of training in agriculture. One may raise as much as one pleases the question whether a liberal education, devised by some one who does not love agriculture, should first be required of students of agriculture, who should then only be allowed, as graduates, to undertake their more technical studies. One may insist as one chooses that agricultural schools, if they are to exist at all, should be separated from the institutions that undertake to educate their pupils in the sense of a higher cultivation. But whatever one thus does by way of formulation, of definition, and of criticism, the state universities will continue to show that the best thing you can do for an agricultural school is to make it an integral part of an academic institution wherein Greek and metaphysics and history and the science of government are also taught; while one of the best things that you can do for the young men who are to be trained in the humanities is to keep both them and their teachers in pretty close contact with the pupils and teachers who are engaged in technical studies. The history of more than one western state university has been the history of the gradual humanizing of a little group of technical schools. A college of agriculture, as it grows, adds to its resources, perhaps, a department of music, a "classical college" is joined to schools of engineering which have already been formed, and thus something is developed which is indeed a highly composite institution. Its functions include those of graduate and undergraduate, technical and professional schools, and also the functions of which we are talking when we speak of the American college. The interesting feature of such institutions is that our lines of division become more and more obviously artificial when applied to them. The function of "the college" in their case becomes intertwined with other func-

tions, technical, professional and scientific! Is such intertwining, is such overlapping and interlacing of functions unwholesome? I think not. I myself welcome the union of technical studies with those which involve a more general cultivation. Men grow so differently, mature at such unequal rates, are cultivated by such different sorts of work, and can use their general cultivation, if they have any, for such various technical purposes, that, for my part I suppose one of the notable functions of an academic institution to be the uniting rather than the further sundering of the various more or less learned activities of modern life, the humanizing of engineers, and the preparation of the young followers of the humanities for some practical service of mankind.

Whatever the functions of "the college" then, it is impossible to treat these functions so as sharply to sunder them from the functions of technical schools. We ought not to say to any one separate class of young men: You want cultivation. That is good. We will therefore give you four years of pure cultivation. Thereafter you shall be ready to undertake something else, which is not cultivation but is your life-work. There are indeed some men who are best trained in just this way. But there are also very various sorts of men in whose cases the most different kinds and degrees of union of technical with non-technical types of training form the best means of educacation. Our undergraduate instruction must reckon with these various sorts of men. We must offer to them various intermediate kinds of education. And we need to have these various sorts of men kept in social relation with one another as they mature. The fortunes of "the college" must not be sundered from those of the technical schools. And this is what the state universities have taught us.

Equally impossible it is to keep asunder, as some theorists wish to do, collegiate instruction and what is called graduate professional instruction. I have for years heard colleagues of mine protest against permitting instruction which they regarded as professional in its nature to count towards a college degree. I have never been able to get from these colleagues any general definition of what, in the modern world, constitutes the distinguishing mark of a professional study. Of course there are professions, notably law and medicine, which can draw their own sharp lines between their particular professional studies and all non-professional studies. These professions wisely begin their training at a definite point, preferably no doubt with college graduates. But then these particular professions are concerned with topics, and with a sort of technique, which can be begun only when the student has a fairly definable degree of maturity. You can not make a young boy a nurse, and you can not wisely begin to give him early clinical instruction. Fragments of legal lore, introduced into undergraduate instruction, tend, we are told, rather to hinder than to help the later work of the law school. So here sharp lines can be authoritatively drawn. But in modern life there are many professions, and, in case of some of these, the boy can already do what it will be almost necessary for the future professional man to have done as early as possible. I was once told by an old sea-captain that an essential part of his life's training was learned in his sailboat, in the harbor at home, when he was a boy, and that he therefore wholly doubted the power of even the best modern naval training school to make a trustworthy ship's officer out of anybody who had not begun to learn the sailor's trade in early boyhood. I need not say that my captain was not alone in this con-

viction, which is that of the old fashioned mariners generally. But what is true of sailors is in various degrees true of other callings. Good engineers can well be made by a training that begins in boyhood, and that certainly ought to include undergraduate training as well as graduate training. And yet I am sure that an engineer ought, amongst other things, to be as cultivated a man as he can be made, and so I am sure that, in his undergraduate days he ought to have an opportunity for various sorts of cultivation that you and I would agree in calling collegiate. Future teachers, future social workers and clergymen, coming civil servants or colonial officials, embryo scientific investigators of all sorts —all these need, during their undergraduate years, training such that nobody can rationally distinguish between that portion of this training which is professional in nature and that portion of it which is apt to add to their general cultivation. Is training in the use of good English a professional study? I know many workers in various professions—contributors, let us say to scientific journals—who would be much better men in their own profession, because decidedly clearer in their wits, in case they had been better trained as school boys and as undergraduates in the accurate use of plain English. Yet what study could be mentioned that is a more typical instance of a so-called culture-study?

I insist then that one can not in any general way distinguish between the educational offices of technical and professional studies on the one hand, and the studies productive of cultivation upon the other. I myself, for instance, ought to teach logic so as to make it professionally useful to future engineers and to future clergymen alike, and to any cultivated man as well, in case he can be induced to be for a while reflective. If I can not do so, that is my defect as a teacher of logic. It is useless to condemn me to the vague task of simply so teaching logic as to exert a cultivating influence over people who have no trade and who have not yet chosen a profession. As a teacher of logic I ought to be required to appeal to anybody who chooses to try the value of my personal appeal to him, whether he is a professional student or a technician, a graduate or an undergraduate.

In a college then, we ought to offer the youth such learning and such training as may prove to be useful in fitting men of their age for the life that they are going to lead, in so far as that is indeed a life which involves intellectual training at all, and in so far as they are youth who are mentally and morally fit to be taught during those years of their life. The unfit, the stubbornly unwilling, the unworthy, we must reject or dismiss. But whosoever will may come, if only the secondary schools have made him fit for a grade of training which experience shows to be in general adapted to reasonably normal folk at his age. And when we get him we ought to make him work as hard as is good for him, and not a whit harder than is good for him, at whatever study will best fit him for his life, whether that proves to be a technical or a so-called professional study or not. Of course we must try to add to his technique general cultivation, of the richest sort that we can get him to assimilate. We can best succeed in that if we teachers keep together ourselves, and unite in one institution the work of very various sorts of scientific and of learned men. Hence, while we shall indeed differentiate more and more our professional and technical schools and modes of training, we college teachers do ill if we unnecessarily separate ourselves and our work from close touch with those of our colleagues whose tasks are more technical and professional than are our own. Only

by union with such teachers can we keep the college near to life.

As to our present condition, in the American college of to-day, I agree with our critics that many college boys do not now work hard enough. The remedy lies, of course, in giving such boys more good work to do, and in employing more instructors whose duty it should be to follow them up personally in their work. The remedy also lies in increasing the effectiveness of our systems of individual advice—in brief in individualizing our methods of dealing with the individual. The remedy does not lie in banishing the work of the investigators to separate institutions, nor in differentiating a colony of pedagogical neuters, who can not generate ideas, nor add to knowledge, but who, as one imagines, can therefore the better teach. We have enough of the barren and unproductive minds at present amongst our college teachers. We want more living and growing investigators than we have. And we want our productive investigators to do more undergraduate teaching than they do. There is a place in the college, of course, for the great teacher who can impart knowledge, but who can not add to it, if indeed his is not really an unproductive mind, but a mind that, like that of Socrates, the prince of teachers, produces indirectly, by acting as the midwife, and by delivering others of the ideas with which their own minds are pregnant. But every effort to separate even this singularly valuable class of teachers from their investigating and originating colleagues, or to keep the investigators as a class by themselves, in institutions to be called universities, and to be sundered from our present colleges—every such effort, I say, seems to me to be in the direction of regression, of pedantry, and if I may speak frankly, of obscurantism. We want teaching and investigation to become more and more what they .ought to be—one and inseparable Some investigators indeed can wisely teach only advanced pupils. Let them confine themselves to such work. Some good college teachers add nothing notable to knowledge. We welcome them whenever they do sufficiently good work of their own kind to make them valuable for the college. Some professional training, by reason of its topic or of its grade, must keep itself well apart from more elementary instruction; let it then do so. But let us not be so terrified by mere names and definitions that we shall set off by itself, in unprofitable isolation from the college, that sort and grade of professional instruction which can also help to awaken and to discipline youth at the collegiate age. And above all let us not be so much the slaves of the mere name *college* as to undertake to draw a sharp line which, in modern life, has no longer a place—a sharp line between all sorts of undergraduate and all sorts of graduate instruction. Many of our graduates need cultivation, badly enough, as all of us know. Many of our undergraduates need pretty advanced studies to wake them up. Let such have them.

As for the unquestionable present evils of too little hard work and too much sport on the part of the college undergraduates of to-day, let us meet these evils in two ways:

1. In general, let us seek to assimilate college work more rather than less to that sort and grade of professional work which calls out a young man's energies just because he feels that in such work something is at stake that is, for him, personally momentous.

2. In detail, let us make the college boy work harder by giving him more work to do, by following him up more closely and individually, and to that end, let us employ more teachers whose work of instruc-

tion shall be individual and personal. Let us abate the evils of sport by fearlessly excluding the mob from our intercollegiate contests, and by rigidly limiting the number of those contests.

In any case, however, let us beware of those theorists who, in the name of what they call the American college, want to sunder afresh what the whole course of our modern American development has wisely tended to join, namely, teaching and investigation, the more technical training and the more general cultivation of our youth, as well as the graduate and the undergraduate types of study. I should abhor the name college if this mere name ever led us into such a backward course as some are now advocating.

Let me say, in conclusion, that, in agreement with Mr. Flexner, I myself believe that a large reform of our relations to the secondary schools, and especially an essential change in our method of college entrance requirements and examinations is called for by the present conditions. But over that whole topic, for my poor wits, the clouds of mystery still hang thick. I leave the matter, and all these now uttered prejudices of mine to the judgment of those who appear to think that they know.

JOSIAH ROYCE

AMERICAN COLLEGE EDUCATION AND LIFE[1]

THERE is evidently a feeling in the minds of the public that there is something the matter with our colleges. The more sensitive and alert educational authorities are likewise aware of certain defects, although they may not agree upon the causes. The more or less definite feeling is that college work on the one hand lacks intellectual seriousness, and on the other fails, somehow, to connect vitally with the present needs of society. Questions as to the length of the course, or the threatened partition of the college between secondary school on the one hand, and the professional schools, including the graduate school, on the other, are really subordinate to this broader question of seriousness and connection. If the college is really worth while we shall doubtless manage the external organization of our system so as to secure its continuance. If the conviction becomes general that it is a survival from the past rather than a useful institution for the present, the really vigorous and ambitious young men will pass it by, and the public will not care to maintain it for the benefit of those who wish merely to spend four pleasant years.

The two chief questions, I conceive, are the value of its intellectual ideals and methods, and the value of its corporate or social life at a certain period in the development of young men and women. I shall confine myself chiefly to the former, in the belief that the intellectual problem needs to be attacked first. The present paper aims to show (1) that the work of the colleges up to about twenty-five or thirty years ago fitted the social situation in both ideal and method; (2) that in the past three decades there has come to be a gap between theory and practise to which the colleges are only in part adjusted; and (3) that the solution is likely to lie through a reconstruction of the college ideal of liberal education under the influence of new vocational methods and ideals. In return we may hope for a gradual permeation of vocations and social institutions by the new spirit and method, which will complete the readjustment between college and life.

I. THE FORMER IDEAL AND METHOD OF COLLEGE AND OF LIFE

The intellectual ideal of the college has

[1] An address given before the Section of Education at the Baltimore meeting of the American Association for the Advancement of Science.

been that of a "liberal culture." This formerly meant three things: As contrasted with studies pursued for utilitarian ends solely or chiefly, it meant genuine intellectual interest. As contrasted with studies determined by the external requirements of future vocation, it meant study directed by the inner, personal valuations, aptitudes, or desires of the scholar himself. In both these respects it meant "liberation," and freedom—freedom for the life of the spirit as over against external necessities or constraints. And in the third place, as predominantly classical, it gave a glimpse of another and different civilization. To the boy or girl brought up in the meager and isolated environment of New England hills or pioneer farm it opened a vista. It gave the æsthetic value of detachment. Some of finer temper caught the full inspiration of converse and companionship with the great minds they came to know. In this sense it was really humanizing. And for ordering one's life and measuring life's values, how could one better gain a point of view from which to see life steadily and whole than in the perspective of the best that had been thought and said?

Now this general scheme of freedom and individualistic literary culture fitted admirably the religious, political and social ideals. For protestantism was religious individualism. Governments were supposed to exist to protect individuals in their natural rights. With practical economic equality, and in a rural, independent mode of life, freedom from external constraint seemed to be the chief social good. And as regards utilitarian demands, in spite of the hard conditions under which life was often led, it was a tradition from early colonial days which had not failed of reenforcement that man's life did not consist in his possessions.

The prevailing *method* of classical study, and of the mathematics and philosophy that went along with it, was also strikingly adapted to the professional training and general social order of the period. For the three professions for which the college prepared were occupied chiefly in deducing the consequences from fixed first principles. Systematic theology or grammatical exegesis was the minister's task in the seminary. The statutes, on the one hand, and past decisions on the other, with some fundamental conceptions of natural rights, were the fixed datum of the lawyer. The physician might be less certain of his ultimate principles, but whether "regular" or "homeopathic," his method was about as dogmatic; and as for society, its social, political and moral standards and categories were all supposed to be established. Even the movement for the abolition of slavery needed only the familiar conceptions of rights and freedom. The moral standards could still be regarded as unchanged. The scriptures and the Declaration of Independence could be appealed to, and although some went so far as to denounce the Constitution, American society as a whole strove rather to make its attitude seem to accord with the Constitution than to admit frankly that social needs had outgrown the Constitution. "Legal fiction," through which the courts like to preserve the semblance of fixed principles, could probably never have been taken so seriously, even by the law itself, if it had not suited on the whole the conservative temper of American society. On the one hand, therefore, the learned professions, on the other, society as a whole, had a relatively fixed system.

How admirably the classical and mathematical method of the time prepared the student for such a scheme of fixed conceptions! Syntax and prosody presented a perfect system, a logical whole, which

needed not to be investigated, but to be learned and applied. The future theologian learned respect for authority as he searched the scriptures of Hadley and Goodwin, or Liddell and Scott. In the statutes and decisions of Harkness the future disciple of Blackstone gained practise in tracing subjunctive or dative back to its constitutional rights and limitations. To watch for agreement in gender, number and case, remains, I am told by legal educators, an unmatched training for legal procedure. Finally, Euclid's axioms were the favorite symbol for the supposedly fixed rules of eternal right which every good citizen should learn to respect and obey. If there was any doubt as to this fixity the course in philosophy was calculated to remove it.

This exact adaptation of the method of college to the methods of the professions seems to account, in part at least, for the results achieved in the way of efficient training. It was maintained and the claim need not here be challenged, that the old college training gave power and effectiveness. Modern experimentation has tended to discredit the abstract conception of "power," gained once for all by some hard study, and then applied to any task that presents itself. But the old training was not isolated or in a vacuum. It was about as near the whole habit of mind and technique of method which later life would employ as anything that could be devised. It was thus essentially, although unconsciously, vocational in method, while "liberal" in ideal.

Both in its intellectual ideal of liberal or free culture, and in its method of instruction the college was therefore well fitted for its former place in American society. No wonder that the educational creator pronounced it all very good. And so long as the Sabbath Day lasted the system was beyond criticism.

II. THE PRESENT SITUATION

The variety of subjects now offered, and the elective system as the method of determining the student's course, are in part due to the activity of science in organizing new materials. With the wealth of resources offered by the natural and social sciences and by modern literatures it seemed impossible to restrict access to the city of the elect to the single straight and narrow path formerly followed. There must be gates on four sides instead of on one. But there has also been a social factor in the change, even if it has not always been consciously recognized.

Economic and social expansion has increased greatly the number of occupations for which trained intelligence is needed. Technical schools have arisen in partial answer to this demand, but the college has made its responses also through its variety of subjects with its freedom of individual selection. The progress of science, as represented especially in the graduate school, has no doubt in many cases given to subjects a specialized mode of treatment which is as technical in its way as the method which any professional school pursues. This apparently suits well the needs of one of the new vocations for which the college has come to be a preparation—that of the teacher. The young women who have come to form so large a part of our college constituency, and who for the most part have been looking forward to teaching, have found their needs well met. But for other occupations, especially for non-professional life, no such vocational connection has been worked out. Studies have become individualistic and detached in a far greater degree than was true of the old curriculum, which was really, though unconsciously, vocational.

But economic and social expansion has had another consequence for the college. It has increased greatly the number of

persons financially able to enjoy the best opportunities available. And whatever the attraction which literature or science may have for some of these intrinsically, or whatever the value a college degree may assume as a mark of social distinction, the real standard of value generated by this whole process, as Professor Sumner has pointed out, is that of "success." The studies of the college course seem to bear little relation to this ideal.

And this leads us to a broader statement. The fixed ideals and standards of the older society, which kept men in their place and held them to their work, have broken down. The churches are feeling the same difficulty. Men are largely absent from the pews. They, or at least many of them, are not taking the churches seriously. Many in former days were kept in the church by the general ideals of the community, and so in college many who had no absorbing interest in the work for its own sake nevertheless yielded to the spirit of college and society, and worked under the general idea that the discipline of the college course was validated in a superior law. Such students no longer feel any external pressure. Serious-minded men are groping for new conceptions in religion, economics, politics and law. But these have not been thoroughly enough worked out as yet to replace the old fixed control. Not only the flippant, but the earnest are more or less at sea as to standards and values. As Mr. Crothers puts it, even "the way of the benefactor is hard."

Some, indeed, seem to feel fairly well satisfied with the situation. President Eliot in his recent work on University Administration has a good deal of faith in the present system if there is a proper intrinsic relation maintained between courses, supplemented by a judicious arrangement of the time schedule. Some colleges have changed their schedules so as to require residence at the week end from those students who had fallen into the habit of spending their leisure half week in neighboring cities. But such considerations, as well as reports like that of the Harvard Committee, and the frank statements of students themselves, point to a real defect. Some would attribute the difficulty entirely to the presence of a frivolous class. But this is evasive. Many, if not most, even of this class, settle down to hard work the moment they enter business or a professional school. And even those who are not on principle averse to anything like strenuous effort feel a certain unreality in the whole situation. There seems to be not only the attitude of "detachment" belonging to the older conception of "liberal" education, but also an attitude which the æstheticians call "make-believe." Now detachment, or even make-believe, may be valuable as a factor in developing a broader, deeper interest, and a more significant, richer purpose. But four years of make-believe seems to be overworking this factor. The young men themselves are coming to think so, and the public at large, while taught to respect the wisdom of its educational experts, is beginning to ask questions.

III. SUGGESTIONS TOWARD READJUSTMENT

The general line along which remedy is to be sought for the present lack of seriousness and lack of connection seems to be *a reconstruction of the college ideal of liberal culture.* This promises to be brought about by a greater introduction of the vocational element and spirit into college work. And this introduction of the vocational into the liberal is being made possible and desirable because *the vocational is being itself permeated and transformed by the liberal.*

The reason for the old-time sharp oppo-

sition of the liberal to the utilitarian and professional was, as we have noted, to protect the intellectual interest and keep the self free from alien constraint or narrow bounds prescribed by vocational conditions. But a new face has been put upon this situation by the development which is going on in the industries and occupations, and in some, at least, of the learned professions. For the various occupations are being organized more and more along scientific lines; they are becoming permeated with intellectual and æsthetic interest; they demand of themselves a wider reach and stimulate a broader survey. In so far as they do this they break down the distinction between the liberal and the vocational. Not the way in which knowledge is to be used—much less the fact that it is not used at all—but the method and spirit in which it is pursued on the one hand, and its breadth of human interest on the other, make it liberal. Any study is liberal, if pursued in a scientific manner and given significance for human life. Such studies call out a widening self. In such studies the mind comes to its own. In such it gains power. In such it is no longer determined by needs or conditions foreign to itself. Rather it is using these needs and conditions as the most effective instruments for asserting itself.

Medicine is perhaps the farthest advanced of the professions in this respect. And the college studies pursued by the future teacher, which are professional so far as their future use makes studies professional, show the absurdity of the old distinction on the basis of utility, or non-utility. For Latin or mathematics as pursued by the future teacher of these subjects is probably more liberalizing than when pursued by those who do not expect to make use of them.

Nor has the process of permeating vocations with scientific interest stopped with the so-called professions. Modern commerce and industry involve the use of intelligence in ways that are properly scientific. And there is no reason why, if studied in their historic development and in their bearing on human welfare, they may not call out as broad and as human an interest as any other field of human activity.

This mutual permeation of the vocations by the scientific and of the liberal by the practical looks, indeed, toward a more effective and positive type of "freedom" than the older conception of the more romantic and negative sort, which sharply opposed the interests of the self to the sphere of its action. The older freedom from constraint corresponded to the formal freedom which was so important an element in political and religious liberty, and which was so prominent an ideal in the last of the eighteenth and during most of the nineteenth centuries. The courts by their distinction between law and fact, which tends to prevent the contamination of legal doctrine by recognition of actual conditions, maintain this theoretical freedom as a basis in many of their decisions. But social and economic facts emphasize that it is positive resources which give the only freedom that amounts to anything. Psychological analysis shows that only as the mind has both ideas and positive control of its instruments is it free in any considerable degree. The student is then free of his world, is fitted to lead a free life, is having a liberal education, in proportion as he is getting such control of the instruments of knowledge and such efficiency in dealing with his fellow men as makes him master not merely of his ideas, his emotions and his purposes, but of his world. The old individualism in education, as in religion, was largely to lose or hold off from the world in order to save the soul by culture.

The new scientific and social situation demands, and in increasing degree will make it possible, that the educated man shall control his world. And in so doing he will save himself. When this conception is embodied in the college there will be no lack of seriousness.

When the colleges have made their work once more a genuine and serious preparation for the new social situation they will be able to give society in turn the aid it needs in changing from the old fixed conceptions, and finding a new type of social order—an order that shall make larger provision for progress. This help, I believe, is to come through the influence of the newer experimental method which largely under the influence of our graduate study is coming to leaven the best work in all subjects. It has its fitness for our new conditions as conspicuously as the older method fitted the conditions of a relatively fixed status.

The laboratory method of studying the sciences began to gain ground in the colleges at about the same time as the introduction of the elective system. It has been strongly reenforced by historical or genetic conceptions given prominence by the doctrine of evolution. Although still very imperfectly carried out, it is replacing more and more the scheme of fixed conceptions and deduction from established rules which constituted the older syntactical, mathematical and moral systems. If this can be carried over into professional conceptions and social organization there will be once more a close connection between the college and society. Medicine and philanthropy have already made notable progress. Theology and religion are feeling the need of reconstruction. The courts are perhaps necessarily the most conservative elements—unless possibly we except schools and colleges—but when legal education has felt fully the force of genetic study we may expect that both criminal and civil justice will consider in greater degree actual human and social conditions in controlling human relations.

And if the established professions need a new method to enable them to fulfill their vocation in the society that is to be, business and industry need the aid of scientific method and standards to make them professional in the true sense. Considering these occupations as non-professional, we have left them no test for the success that every normal man wishes to secure, but that of economic gain. And since economic gain may result either from service or from exploitation, our educational theory and training have lent no such powerful support to the conception of public service through one's vocation as the scientific standards of law, medicine and teaching afford members of those professions. As President Eliot has pointed out, this purely financial standard has not proved a conspicuous success even from the standpoint of efficient management of business enterprise. Is it not desirable that education should try to introduce other and more scientific standards? And is it too high-flying an optimism to hope that the time may come when it will be considered as unprofessional to manage a country's industries or transportation or banking with an eye principally to financial gain as it now is to practise medicine with such a standard of success? The scientific and the ethical here go hand in hand.

The professional schools themselves are not likely to embody this method in its full significance in their work. The function of the college intellectually is to make this the dominant temper of the student.

And the second intellectual function of the college is to give material for the future citizen. First of all, he must know

society. The social sciences ought to be strongly developed. But training for a democratic society is not limited to a peculiar subject. Nothing human is foreign to the purpose of the college. But it is a fair question whether literary study may not be for the college less an end in itself and more an avenue through which one comes to know and sympathize with all sorts and conditions of men. And even the natural sciences need not hesitate to let their bearing on human welfare appear.

An experimental method and a social standpoint are, I conceive, the two respects in which the college should perform its office of liberal training in a way suited to our new conditions.

In view of the fact that women now form so large an element in our colleges, it may be permitted to point out some special applications of these considerations to woman's education on the one hand, and to the determination of woman's place in the social order on the other.

College education for women has thus far followed essentially the lines laid down by the general system already in vogue. "Equal opportunity" was the watchword at first, and it is probable that any differentiation in kind might have been regarded as involving inferiority in standard or value. "Woman's work" is still, it must be confessed, often treated by the world in general as implying a depreciatory estimate. As already noticed, a large number of women, looking forward to the occupation of teaching, have found the existing courses largely vocational. For this, or other reasons, the lack of intellectual seriousness has thus far not been so much in evidence as with the men. But as an increasingly larger proportion of the women students will not become teachers, the question of connection between college work and after life is likely to become more acute. The need for introducing into college more material of a vocational sort, and conversely of permeating woman's vocational work of all kinds with a scientific method and a broadly human interest, is likely to become increasingly evident. The work of the woman in the home has lagged far behind the occupations of men in point of organization and of the use of scientific method. An educated woman is apt to feel, vaguely, that the whole household life—once the center of all the industries, and the place where discovery and invention had their chief seat—has now been left behind in the progress of civilization and is no longer a field for the exercise of intellectual powers of the highest order. This inevitably tends to depreciation of such occupation, and to strain in the family life.

Some would find the remedy by purely sentimental and emotional exaltation of home life. They would in effect continue the separation between the scientific spirit and the home. Is it not more promising to work, rather, along the lines suggested in the case of men's vocations, and try to liberalize women's vocations by scientific methods and a more broadly human standpoint? It is not yet sufficiently recognized, for example, that in modern city life the home is virtually coterminous with the city. The sanitation, the food supply, the health of the home are now dependent on municipal conditions; the education of the children, the influences that surround them, the ideals that influence them are reached chiefly by forces that are civic and philanthropic in a broad sense, rather than domestic in the narrow sense. And further, while the organization of production, the conduct of litigation, and various other traditional vocations are likely to remain predominantly in the hands of men, it is increasingly apparent that as wealth increases beyond provision for bare necessities woman becomes the more im-

portant factor in determining the course of consumption. Vocational training for woman will then be conceived broadly enough to enable her to plan not only economically, but with taste and refinement for those satisfactions that are permanent and genuine, and also with intelligent judgment for those that make for the larger social welfare.

And the final application of the experimental method in this connection lies just in the determination of what women's vocations are ultimately to be. The older society had no doubts. The religious, economic, political and social status of woman could all be deduced with perfect exactness. It was as easy as the agreement of a verb with its subject. The present equilibrium is unstable. Is it not a scientific method to work out the problem with careful reference to the new conditions as they emerge, rather than to decide by past history or fixed conceptions?

In conclusion I may barely hint at a question which no doubt arises as to the bearing of this whole discussion on the college as a distinct organization. If professional education is to become liberalized, what need of the college? And if the spirit of investigation is the main factor, why again the college? Why not the university joined directly to the secondary school? In the long run I think this is likely to depend on the need of a factor which has been barely referred to above. Effective education depends in part on a scientific factor, but there is also a personal factor. One must know his fellows and how to cooperate with them. This is increasingly important with the growing complexity of society. And this efficiency in dealing with others is not easily secured in professional or graduate school where the emphasis is on subject and method, and the life is individualistic. If the college can maintain a corporate life in which knowledge is vitalized, in which there is actual give and take, actual sympathy and friction, active interchange not only between mind and mind but between will and will, then it will find its own place, and live secure.

James H. Tufts
University of Chicago

THE PROPOSED HAWAIIAN MEETING IN 1910

The action taken by the general committee of the American Association for the Advancement of Science at the Baltimore meeting in again unanimously re-affirming a resolution adopted at the Chicago meeting of a year ago to the effect that it was desirable to hold a meeting of the association in Honolulu during the summer of 1910, provided suitable arrangements can be made, is quite generally regarded as a flattering acceptance of Hawaii's cordial and urgent invitation.

All Hawaii is united in the desire that their invitation be extended to each of the individual members of the American Association for the Advancement of Science, and of the affiliated societies, and to their families and friends. Keen delight is expressed at the prospect of welcoming the scientific men of America to the "Land of the Heart's Desire," for such a meeting and outing. Hawaii is prepared and willing to do all in its power to make the meeting a large, notable and important gathering not only of the scientific men of America but of the other countries that border on or have possessions in the Pacific Ocean. To this end elaborate preparations are being made for the entertainment of all who may attend.

A strong local committee has already been formed. They have printed and ready for general distribution a number of pamphlets setting forth the things prospective visitors will want to know about Hawaii. The probable cost of the trip from the east will not necessarily exceed $300. An especial booklet emphasizing the desirability and advantages of Honolulu as a summer meeting place and the things of interest to be seen by the scien-

tific visitors in the island was especially prepared for distribution at the Baltimore meeting. Those who desire the literature or wish information about the trip or are in any way interested in the meeting are requested to address Mr. Albert F. Judd, Secretary Hawaii Committee, Judd Building, Honolulu, H. I.

It is desired that you state to the committee the particular subject that interests you most that detailed information may be sent you thereon. The farther advantages of having your name and address will be that it will enable the local committee to keep you informed of special rates and other matters of interest to those contemplating the journey. It is desirable at the present time to secure the assurance of your interest, the matter of coming can await further consideration.

WM. ALANSON BRYAN

SCIENTIFIC NOTES AND NEWS

THE meeting of the Chicago Academy of Sciences on February 23 was in honor of Charles Darwin. Professor C. O. Whitman, of the University of Chicago, gave an address on "Some of the Principles of Organic Evolution as revealed in the Pigeon World."

THE Rochester Academy of Science held on February 22 a meeting in commemoration of the Darwin centennial. Addresses were made by Professor C. W. Dodge, on the life and work of Darwin; by Professor H. L. Fairchild, on Darwin and geology; and by Professor W. D. Merrill, on Darwin and botany. An exhibition was made of material illustrating evolution.

WE learn from *Nature* that at the meeting of the Royal Society on February 18, telegrams of congratulation on the hundredth anniversary of the birth of Charles Darwin were read from the University of Christiania, the University, Kharkoff, the Naturalists Students Association, Kharkoff, the Society of Naturalists, Kharkoff, the council of lecturers, Moscow Women's University and the Swedish Academy of Sciences, Stockholm. The president reported that telegraphic acknowledgments and thanks had been transmitted to the senders on behalf of the Royal Society.

A MEETING of the Leeds Naturalists' Club was held on February 15 to celebrate the Darwin centenary, when Mr. Harold Wager, F.R.S., delivered an address on the life and work of Darwin.

M. H. POINCARÉ has been elected president of the French Bureau des Longitudes.

THE University of Liverpool will confer its doctorate of laws on Mr. William Marconi; its doctorate of science on Mr. Francis Darwin and Mr. J. L. Todd and its doctorate of engineering on the Hon. C. A. Parsons.

THE universities of Oxford and of Cambridge have conferred the degree of D.Sc. on Dr. Sven Hedin.

THE seventieth birthday of Dr. G. Lunge, professor of chemistry at Zurich, will be celebrated on September 15.

DR. DAVID STARR JORDAN, president of the American Association for the Advancement of Science, has appointed the following committee to inquire into the manner and course of publication, distribution and use of publications, of American scientific societies: Franz Boas, chairman; R. S. Woodward; William Trelease; J. McK. Cattell; E. G. Conklin.

MR. A. L. BOWMAN is chairman of a special committee appointed by the American Society of Civil Engineers "to consider and report upon the design, ultimate strength and safe working values of steel columns and struts."

MR. JOHN C. OSTRUP, professor of structural engineering at the Stevens Institute of Technology, has been elected a member of the Institution of Civil Engineers of Great Britain.

MR. W. F. BATTERSBY, of the School of Mines, Kingston, Ontario, has won the prize of one hundred dollars which was offered by Mr. J. B. Tyrrell, of Toronto, for the best collection of minerals made in the Province of Ontario during the past year.

PROFESSOR W. M. DAVIS, of Harvard University, now serving as professor in the University of Berlin, has conducted a geological

excursion of some sixty students through the Wera and Leine Valleys.

Sir Rubert Boyce, F.R.S., dean of the Liverpool School of Tropical Medicine, is on behalf of the Colonial Office visiting the West Indies for the purpose of looking into the present methods of dealing with sickness and recommending what can be done to promote the physical welfare of the people.

The Yale Chapter of Sigma Xi held its annual banquet February 27, following the initiation of the new members. Dr. W. N. Rice, professor of geology at Wesleyan University and holder of the first doctor's degree awarded by Yale for study in geology, delivered the formal address of the evening. He spoke on "The Return to Faith," discussing the newer relation of science to religion. Other speakers were Professor Ross G. Harrison; Professor William Hallock, of Columbia University; Professor Charles W. Brown, of Brown University; Assistant Professor R. C. Hawley, '04F., Davenport Hocker, '08, and F. L. Gates, '09.

At the meeting of the Chicago Section of the American Mathematical Society, the following officers were elected: G. A. Miller, University of Illinois, *chairman;* H. E. Slaught, University of Chicago, *secretary;* O. D. Kellogg, University of Missouri, *member of the program committee.* The next meeting of the section will be held at the University of Chicago on April 10 and 11.

At the annual meeting of the Physical Society, London, the following officers were elected: *President,* Dr. C. Chree; *vice-presidents,* those who have filled the office of president, together with Mr. W. Duddell, Professor A. Schuster, Mr. S. Skinner and Dr. W. Watson; *secretaries,* Mr. W. R. Cooper and Dr. S. W. J. Smith; *foreign secretary,* Professor S. P. Thompson; *treasurer,* Professor H. L. Callendar; *librarian,* Dr. W. Watson.

At the anniversary meeting of the Geological Society of London, the officers were elected as follows: *President,* Professor W. J. Sollas; *vice-presidents,* Mr. G. W. Lamplugh, Mr. H. W. Monckton, Dr. J. J. H. Teall and Professor W. W. Watts; *secretaries,* Professor E. J. Garwood and Dr. A. Smith Woodward; *foreign secretary,* Sir Archibald Geikie; *treasurer,* Dr. Aubrey Strahan.

The Congress on Tropical Diseases, which was opened at Bombay on February 22, was attended by representatives of all parts of India and by Major Ronald Ross, of Liverpool, Professor Shiga, of Japan, and Dr. Musgrave, of the Philippines. The congress is accompanied by a popular medical exhibition.

Dr. Frederick W. Taylor, past-president of the American Society of Mechanical Engineers, gave an address before the College of Engineering of the University of Illinois on February 18.

Professor Charles L. Edwards, of Trinity College, will address the Scientific Society of Stamford, Conn., on March 12, on the subject of "The Methods and Results of Deep-sea Exploration."

Dr. George Grant MacCurdy, of Yale University, gave a lecture before the Buffalo Society of Natural Sciences on February 26, his subject being "The Ancient Art of Chiriqui."

A memorial has just been erected in Kensington Cemetery, London, to the memory of Admiral Sir Francis Leopold McClintock, the Arctic explorer and discoverer of the lost Franklin expedition. It takes the form of an old style wheel cross standing on a massive molded base, reaching to a height of 10 feet and executed in rough silver-gray Cornish granite.

Dr. James W. Moore, professor of physics in Lafayette College since 1872, died on February 28, at the age of sixty-four years.

Sir George King, F.R.S., eminent for his researches on the flora of India, died on February 13, at the age of sixty-eight years.

Dr. David James Hamilton, lately professor of pathology at Aberdeen University and eminent as a pathologist, died on February 19, in Aberdeen, at the age of 60.

A government laboratory of bacteriology has been founded in Warsaw. The director is Dr. Tscharnozky. The laboratory is in-

tended chiefly for the purposes of veterinary and public health researches.

THE University of Heidelberg has received from a foreign benefactor interested in the advancement of science the sum of over $30,000 towards the foundation of a radiographic institute.

DR. FRANCIS ELGAR, F.R.S., the naval architect, who died on January 17, aged sixty-three, left an estate of the value of £80,000. The testator left £1,600 to the Institution of Naval Architects for the endowment of a scholarship. After making other bequests, he left half of the residue of his property (which will apparently amount to about £33,000), subject to the interest of his wife during widowhood, as to one half to the Institution of Naval Architects for the encouragement of the science and art of naval architecture, and one half to the University of Glasgow, to be held upon trust for the furtherance of the objects of the John Elder chair of naval architecture in that university.

A BALLOT of the proprietors of the London Institution on the proposed amalgamation with the Royal Society of Arts has been taken and resulted as follows: For amalgamation, 322; against, 218. The proprietors, of whom there are 850, were asked to say whether they approved of the drafting of an act of parliament for the amalgamation of the two institutions on the lines of the scheme which was drawn up by the joint committee in 1905. In a preliminary postcard poll 524 voted in favor of the proposal and only 84 against it.

OFFICIAL information has been received by the U. S. Bureau of Education at Washington that an International Musical Congress will be held at Vienna at the end of May, 1909, in connection with the centennial celebration of the birth of Josef Haydn, the composer. A desire has been expressed that the United States should be represented in this congress.

AN International Exhibition of Hygiene will be held at Turin during September, October and November.

WE learn from the *British Medical Journal* that the second International Conference on Leprosy will be held this year at Bergen from August 16 to 19. The preliminary program includes the following subjects: The geographical distribution of leprosy; the forms and diagnosis of the disease; its causes and manner of propagation; its pathological anatomy, and its treatment. The conference will be held under the patronage of the Norwegian Government and King Haakon. The president will be Dr. G. Armauer Hansen, discoverer of the *Bacillus lepræ*. The vice-president is Professor C. Boeck, of the University of Christiania, another recognized authority on leprosy. The secretary is Dr. H. P. Lie, of Bergen, to whom all communications relative to the congress should be addressed.

WE learn from the London *Times* that at a meeting of the joint organizing committee of the International Congress of Applied Chemistry, held in the rooms of the Chemical Society at Burlington House, the secretary presented a report giving details of the progress made since the last meeting of the committee in June, 1908. It was stated that £4,400 had been received in response to a special appeal issued in December. The government was stated to be considering the question of defraying the cost of the South Kensington group of buildings, belonging to the University of London, for the meetings of the congress. Several members of the government have accepted the offices of honorary vice-presidents of the congress, including Lord Morley (Secretary of State for India) and Mr. Haldane (Secretary of State for War). The Society of Chemical Industry, which numbers over 4,000 members, has arranged to hold its annual meeting for 1909 in London on May 26, the day preceding that of the opening of the congress, and the London members of this society have also arranged to entertain the members of the congress on the evening of May 29. Foreign and colonial governments, and the leading scientific and technical societies, have been asked to appoint delegates to represent them at the congress. These delegates will rank as honorary and as ordinary members of the congress respectively.

UNIVERSITY AND EDUCATIONAL NEWS

By action of the corporation the chair of the theory and practise of medicine at Yale University will hereafter be known as the John Slade Ely professorship of the theory and practise of medicine. This action was made possible by the gift to the university of $50,000 by an unknown donor for the purpose of establishing a memorial to Professor Ely, '81S., who filled this chair from 1897 until his death, February 7, 1906. Dr. George Blumer at present holds this professorship.

It is announced that Hamilton College will receive a bequest of $50,000 from Mrs. Annie P. Burgess, of New York City, who died about three years ago, leaving for educational and charitable purposes upward of $200,000. This included $10,000 to Columbia University and to Barnard College for scholarships. After making some other specific bequests she left the remainder of her estate to Hamilton College, Columbia University and Barnard College.

Among the bequests left by the late Mrs. Emma Cummings, of East Hampton, L. I., are $25,000 to Dartmouth College and $25,000 to Bowdoin College.

The late Dr. Charles H. Roberts, of Highland, N. J., in his will provided for the founding of five scholarships of $240 annually at Cornell University.

Harvard University has received a gift of $150,000 for the endowment of the University Chapel. The fund is to be known as the Edward Wigglesworth Memorial Fund.

Maryville College, Tennessee, has secured an endowment of $227,000, of which $50,000 is from the General Educational Board and $50,000 from Mr. Andrew Carnegie.

The University of Michigan has acquired by gift of an alumnus, and from the city of Ann Arbor, a tract of land of about ninety acres to serve as a botanical garden and arboretum. This land has an exceptional variety of soil, elevation and exposure, including a border of over one half mile on the Huron River, easily accessible from the campus. The Woman's League of the university has purchased a seven-acre tract of land, convenient of access, which will be developed as an athletic field for the women of the university. Another gift is of about fifteen hundred acres of land, lying along the shores of Douglas lake in Cheboygan county. This land will serve as the site for the summer engineering camp, and its topography, including forest and open, land and water, various elevations, etc., is well adapted to the purpose. In honor of the donor it has been named The Bogardus Engineering Camp.

Mrs. S. T. Robinson, of Lawrence, Kansas, is offering an opportunity to all women who graduate from the science department of the University of Kansas to do research work in connection with the research table supported by her in the Marine Biological Laboratory at Woods Hole.

The Russian government has decided to establish a new university at Saratoff, and the duty of organizing it has been entrusted to Dr. Rasumowsky, professor of surgery at Kasan.

Governor Draper, of Massachusetts, has appointed Mr. Frederick P. Fish, of Brookline, to be a member of the State Board of Education, to succeed the late Carroll D. Wright. Mr. Fish is a member of the board of overseers of Harvard College and a member of the corporation and executive committee of the Massachusetts Institute of Technology.

DISCUSSION AND CORRESPONDENCE

THE MISSISSIPPI CHANNEL BOTTOM AND GULF LEVEL

To the Editor of Science: The remarkably slight elevation above the sea of the lower flood plains of large rivers like the Mississippi, the Ganges and the Amazon is a matter of frequent comment. The facts are often put rather strikingly by saying that at St. Louis, 1,250 miles by river from the sea, the valley flat is but 400 feet above sea level; at Memphis, 842 miles from the sea, 220 feet; and at Vicksburg, 472 miles from the sea, 90 feet. The same fact is commonly expressed

in terms of the gradient of the river. The Mississippi has a gradient of a few inches per mile from Cairo to the gulf; while the Amazon, rapidly aggrading its flood plain and still quite under the dominion of the waste delivered to it, has, according to the best barometric determinations, an average gradient for the last 500 miles of only one eighth of an inch per mile![1] Barometic determinations are notably unreliable, but errors are at a minimum near sea level in the tropics and this value may be taken as indicative of at least the order of magnitude of the river gradient. The Nile has now been carefully measured by an almost complete line of leveling from Victoria Nyanza to the Mediterranean, a distance of 3,500 miles. It offers a similar set of conditions in its flattest part between Sorbat and Khartum, where the slope has been reliably determined to be from one half to one third of an inch per mile.[2] More striking is the statement of elevation in terms of channel bottom: "the bottom of the channel of the Mississippi is as much as 100 feet below the level of the gulf some 20 miles above New Orleans."[3]

It occurred to the writers that in the case of the Mississippi a possibly still more striking form of expression is that which refers the elevations of channel bottom to sea level, thus arriving at an upstream point where the plane of sea level intersects the channel bottom. The distance of this intersection from the sea or the river mouth is a very striking value indeed. The detailed results of our map examination are expressed in the following table which is compiled from the charts of the Mississippi River Commission based on the surveys of the period 1879–1884. The table shows the maximum depressions and elevations of the channel bottom that occur on each chart, the location of each point (referred to a station usually near some town or landing), together with its distance from the gulf. It will be observed that the first upstream point at which the channel bottom attains gulf level is 388 miles by river from the gulf. The most northerly point at which the bottom occurs at gulf level is 181 miles farther up the river, or 569 miles from the gulf! Here in a narrow and extremely sharp bend the channel reaches a depth of 135 feet, or more than the elevation of the surface of the stream above gulf level at this point.

Chart No.	Maximum Elevation of Channel Bottom above Gulf Level[4]	Minimum Elevation of Channel Bottom above Gulf Level[4]	Location	Miles from Gulf (Cairo = 1072)
55	0		1 mile below Lake St. John Landing	*388*
		—89	1 mile below Giles Landing	374
54	— 5		7 miles below Coles Creek Landing	393
		—61	2 miles below Coles Creek Landing	398
53	+10		3 miles below Buena Vista Landing	409
		—55	6 miles above Buena Vista Landing	418
52	+10		2 miles above St. Joseph	425
		—60	1 mile below St. Joseph	422
51	+37		1 mile below Grand Gulf Landing	435
		—33	10 miles above Grand Gulf Landing	446
50	+12		2 miles above New Town Landing	455
		—12	6 miles below New Town Landing	447
49	+30		2 miles above Warrentown	467
		—30	4 miles above Warrentown	469
48	+22		4 miles below Vicksburg	479
		—54	1 mile below Vicksburg	482
47	+33		5.5 miles below Milliken's Bend Landing	486
		—32	1 mile above Milliken's Bend Landing	492
46	+37		4 miles above Villa Vista Landing	503
		—26	At Villa Vista Landing	498
45	+44		7 miles below Arcadia Landing	505
		—21	4 miles below Arcadia Landing	508
44	+53		1 mile below Shepard Landing	525
		—10	1 mile above Shepard Landing	528
43	+61		6 miles above Nelson Point Landing	547
		— 6	0.5 mile above Nelson Point Landing	541
42	+51		0.5 mile above Carolina Landing	555
		—26	5 miles below Carolina Landing	550
41	+64		2.5miles above Lake Washington Landing	*569*
		—29	4 miles below Lake Washington Landing	563

Here in a narrow and extremely sharp bend the channel reaches a depth of 135 feet, or more than the elevation of the surface of the stream above gulf level at this point.

ISAIAH BOWMAN
C. F. GRAHAM
YALE UNIVERSITY

[1] Colonel G. E. Church, "South America: An Outline of its Physical Geography," *Geog. Journ.*, Vol. 17, 1901, p. 382.

[2] Reported in a paper on the longitudinal section of the river delivered at the 1908 meeting of the British Association and noted in *Nature*, October 15, 1908, p. 617.

[3] Chamberlain and Salisbury, "Geology," Vol. 1, p. 162.

[4] Elevations have been referred to sea level by computations based on the relation of the datum plane for each sheet to gulf level at Biloxi, Miss.

THE NAMING OF NEW SPECIES

To the Editor of Science: The volume of *Proceedings* of the United States National Museum for 1908 has just come to hand with its usual wealth of zoological literature, much of which is naturally of a systematic character. As I have looked through the various articles, and have noted the large number of new species described, I have been struck by the very considerable proportion of names given "in honor of" somebody, or derived from a geographical or geological locality. In other words, the percentage of specific names which are in any sense descriptive or suggestive to a fellow-worker in the same group, is very small, and I am therefore moved to call the attention of systematic zoologists (including, of course, the paleontologists) to what seems to me a very unfortunate tendency among us. The naming of an animal "in honor of" some one has much to recommend it from the personal point of view, if we agree not to debate the question whether it *is* an honor to have a parasitic worm, a skunk or some other unlovable creature named in one's honor. But from the scientific point of view, the custom of using personal names for the designation of particular animals has little to commend it, except possibly where the name of some preeminently great master of a field may be perpetuated in connection with the group upon which he worked; something may be said in favor of *darwini* as the name of a cirriped. The use of names derived from localities or geological horizons has more to recommend it, for such names may be, and often are, suggestive and distinctive. But they are very apt to be shown, by further advances of knowledge, to be not only inapplicable, but oftentimes misleading, and they should only be used where there is little chance for blunders. It seems to me a great pity that we can not return to the original idea for a specific name, that it should be in some sense descriptive. Of course it must be admitted that many names of this class are very misleading, but that fact should only make us more careful in the selection of the names we give. Many zoologists do not realize what the situation really is and I therefore wish to give an analysis of the papers in the volume of *Proceedings* before me.

There are 30 articles in which new species are described, 24 of which deal wholly with recent, and 6 with fossil, species. In the thirty articles 223 new names are proposed for species, besides a number of varieties and subspecies which I have left out of the account. Of the 223 names, 130, or 58 per cent., are in some degree descriptive; 47, or 21 per cent., are names of persons; 45, or nearly 21 per cent., are locality names, and 1 is of doubtful significance.

Of course the 130 names are not all equally descriptive, some are very doubtfully so. The 45 locality names include names derived from geological horizons. The 47 names of persons include 40 individuals, one of whom is honored (?) no less than three times. When it is realized that this honor (?) is sometimes actually asked for, directly or indirectly, it may be seen how very dubious it is. Of the forty individuals, I can count but nine whose scientific attainments can fairly be said to warrant their being chosen; others, of course, would differ from me in the count, but I think no one would find twenty.

Among the thirty papers, some are notably free from the evils I am pointing out. Mr. A. H. Clark's papers on Crinoids include 29 names, of which at least 86 per cent. are descriptive (the derivation of *komachi* is beyond me, so I have not called it descriptive) and Mr. William Warren's paper on geometrid moths includes 34 names of which 94 per cent. are descriptive. Deducting these papers, we find that of 160 names, 73, or less than 46 per cent., are descriptive; 43, or 27 per cent., are personal, and 44, or more than 27 per cent., are locality names.

But Professor Nutting's report on Hawaiian Alcyonaria includes 38 names, of which nearly 77 per cent. are descriptive (8 are personal), and if we deduct these names, we find that of the remaining 122 names, 44, or only 36 per cent., are descriptive; 35, or 28½ per cent., are personal, and 43, or 35½ per cent., are locality names.

Examination of the remaining papers reveals the fact that the paleontological writers pay the least attention to descriptive names, for in their six papers, we find that of 59 proposed specific names 5, or less than 10 per cent., are descriptive; 23, or 38 per cent., are personal, and 31, or over 52 per cent., are locality names.

It would be uncharitable, if it were not quite uncalled for, to suggest either of the two most obvious reasons why an author, particularly a young or inexperienced writer, selects personal or locality names for his new species. But I can not avoid the feeling that these reasons occur to our fellow workers in the other fields of zoology, and may have something to do with the feeling, which it is often said they hold, that we systematists are engaged in a lower grade of work than that with which they are occupied.

HUBERT LYMAN CLARK
MUSEUM OF COMPARATIVE ZOOLOGY,
CAMBRIDGE, MASS.,
January 20, 1909

THE 6-INCH TRANSIT CIRCLE OF THE U. S. NAVAL OBSERVATORY

TO THE EDITOR OF SCIENCE: The following paragraph, which is an essential feature of a paper read by me before Section A, American Association for the Advancement of Science, in Baltimore on December 28, 1908, has been omitted from the abstract of that paper printed in SCIENCE for January 22, p. 154:

"It having been found that the instrument had suffered some damage from gradual deterioration during the five years that it had been out of use, the axis tube and circles and various other parts were sent to Warner & Swasey for repairs with a view to put the instrument in condition to do the fundamental work for which it was originally intended. This work is now nearly finished and the axis and some other parts of the instrument have been returned to the observatory. The pivots have been reground with great care, and elaborate tests have shown them to be very regular in shape and so nearly equal in size that the difference is inappreciable. It is hoped that the remaining parts of the instrument will be returned to us in a few days, in which case measures will be taken immediately to mount the instrument and commence the work of investigation and observation."

MILTON UPDEGRAFF

SCIENTIFIC BOOKS

Resultats du voyage du S. Y. Belgica en 1897, 1898, 1899, sous the commandement de A. de Gerlache de Gomery. Rapports Scientifiques. *Oceanography,* par HENRYK ARCTOWSKI et HUGH ROBERT MILL, 1908. *Physique du Globe,* mesures pendulaires, par G. LECOINTE, 1907. *Zoologie: Turbellarien,* von LUDWIG BÖHMIG, 1908. *Scaphopoden,* von L. PLATE, 1908. *Pennatuliden,* von HECTOR F. E. JUNGERSEN, 1907. *Cirripedia,* by P. P. C. HOEK, 1907. *Geologie:* Glaciers, par HENRYK ARCTOWSKI, 1908.

The reports of the *Belgica* expedition continue to appear, each adding to our knowledge of the Antarctic, its conditions or its fauna. The numbers of which the titles are summarized above are not less interesting than those which preceded them. Space permits but a brief account of their contents.

The soundings and serial temperatures of the sea water taken by the *Belgica* were the first in that region to be observed and corrected by the most modern instruments and methods. Two conclusions are of especial interest. The observations showed that the deeper waters of the Atlantic and Pacific are practically separated by submarine ridges which, extending from the southern end of the American continent to the Antarctic lands, present a barrier to the free circulation of the waters in question. Secondly, it is proved that the surface water of the sea is cooled by the low Antarctic air-temperatures and by floating and melting ice, below which is a warmer stratum which reaches its maximum temperature two or three hundred fathoms below the surface, after which the temperature gradually diminishes until the bottom of the sea is reached. The persistency of the warmer stratum indicates the slowness of changes due to convection, and the existence of currents

by which the warmer waters from the north replace the colder upper stratum which moves from the south. The temperatures naturally have a very narrow range, comprised within ten degrees of the point (28° F.) where sea water freezes.

The report on the pendulum observations is preceded by a short and pathetic account of the life and services of Lieutenant E. Danco, who died on the *Belgica,* at the age of twenty-nine years and to whom these observations had been confided. A fine portrait of Danco accompanies the notice. The work was carried on subsequently by Lecointe, but owing to a variety of circumstances the value of gravity was obtained by the expedition only at Punta Arenas in the Straits of Magellan.

In his discussion of the glaciers and bergs Arctowski considers first those of Tierra del Fuego, and secondly those of Gerlache Bay and the Antarctic lands. He concludes that the mountainous region of both was once continuous, the geology indicating much the same characteristics. He also contrasts the effect of the ice cap where incomplete and broken by nunataks, and when existing as a continuous covering extending to the sea level. In the latter case and for Antarctica generally he is disposed to believe that the ice is exercising a comparatively small abrasive function, and that its effect on the subjacent rock is very slight at present, the glacial streams being clear instead of milky and rock forms exposed by the retreating ice rounded off rather than channeled or excavated. This memoir is illustrated by numerous excellent half-tone plates derived from photographs.

The report on the barnacles considers a few Magellanic forms and one new truly Antarctic species, *Verruca mitra,* obtained in some 250 fathoms in south latitude 70°. Only one strictly Antarctic species was previously known, the *Scalpellum antarcticum* Hoek, obtained by the *Challenger.*

Only one species of Pennatulidæ was obtained on the expedition. This belongs to the genus *Umbellula* first described from the Polar Sea by Ellis from a dry specimen obtained in 1753. The *Belgica* species is *U. carpenteri* Kölliker, first obtained by the *Challenger.* Two other species are known from the Antarctic, of which one is so close to the Arctic *U. encrinus* of Linné as to be regarded by Kölliker as the same species.

Only two scaphopods were recognized by Plate in the collection, from south of latitude 70° S. One is referred to the *Dentalium majorinum* of Mabille and Rochebrune, variety *gaussianum,* previously described from material obtained by the Gauss expedition. The other, though probably a distinct species, was not sufficiently perfect for description.

The turbellarians comprised a new genus and species of Acoela, *Rimicola glacialis* Böhmig, and three species of Tricladida, of which one, *Procerodes hallezi,* is described as new. The latter is Fuegian, having been dredged in Beagle Channel. A new genus and subfamily are described to include *Procerodes* (now *Stummeria*) *marginata* Haller. The forms discussed are anatomically described and figured in great detail.

Wm. H. Dall

A Text-book of Mechanical Drawing and Elementary Machine Design. By John S. Reid, Professor of Mechanical Drawing and Designing, Armour Institute, and David Reid, formerly Instructor in Mechanical Drawing and Designing, Sibley College, Cornell University. Revised edition, enlarged. Pp. xi + 433. New York, John Wiley & Sons. 1908.

It would be difficult, in fact practically impossible, to compress within equal limits more of service to the student of machine design who wished at the same time to qualify as a draftsman. Not only are all necessary proportions and tables given for the designing of screws, nuts, bolts, keys, cotters and gibs, riveted joints, shafting, pipes and couplings, bearings, belt and toothed gearing, valves and general engine details, but there are also full data for drafting courses, with the unusual feature of time-allotment included, securing the early attainment by the novice of a commercial rate of speed in his work.

As indicative of the methods and procedure in one of the leading technical schools the book is of especial interest to teachers of

drafting; while the student who must, by force of circumstances, be self-instructed, could not be better provided therefor.

The treatment of valve-motion is admirable. The precedence given the Bilgram diagram over the Zeuner, although unusual, is fully warranted, the former being far superior for designing, while possessing equal merits with the latter for analysis.

The frequent shaded perspectives will be especially appreciated by the beginner in machine drawing, obviating, as they do, in considerable degree, the necessity for the models recommended but not always obtainable.

Among the more important features appearing for the first time in this edition are the "Course in Lettering" and the "Present Practise in Drafting Room Methods," the latter a summary of replies, from two hundred of the leading engineering firms of this country, to thirty-five questions as to shop practise. An ample index completes this altogether valuable work.

FREDERICK N. WILLSON

SCIENTIFIC JOURNALS AND ARTICLES

THE February number (volume 15, number 5) of the *Bulletin of the American Mathematical Society* contains the following papers: "The Second Regular Meeting of the Southwestern Section," by O. D. Kellogg; "Remarks Concerning the Second Variation for Isoperimetric Problems," by Oskar Bolza; "Notes on the Simplex Theory of Numbers," by R. D. Carmichael; "The Solution of Boundary Problems of Linear Differential Equations of Odd Order," by W. D. A. Westfall; "A Class of Functions Having a Peculiar Discontinuity," by W. D. A. Westfall; "On Certain Determinants Connected with a Problem in Celestial Mechanics," by H. E. Buchanan; "Sylvester's Mathematical Papers," by L. E. Dickson; "Hilton's Finite Groups," by Arthur Ranum; "Shorter Notices": Ball-Freund's Histoire des Mathématiques, and Günther's Geschichte der Mathematik, by D. E. Smith; Tannery's Manuscrits de Evariste Galois and Minkowski's Diophantische Approximationen, by L. E. Dickson; Sturm's Lehre von den geometrischen Verwandtschaften, Band II., by Virgil Snyder; Arnoux's Arithmétique graphique, by W. H. Bussey; Enriques-Fleischer's Fragen der Elementargeometrie, by H. E. Hawkes; Poincaré's Leçons de Mécanique celeste, by F. R. Moulton; Gutzmer Tätigkeit der Unterrichtskommission, by J. W. A. Young; "Notes"; "New Publications."

The March number of the *Bulletin* contains: "The Fifteenth Annual Meeting of the American Mathematical Society," by F. N. Cole; "The Winter Meeting of the Chicago Section," by H. E. Slaught; "The Sixteenth Meeting of the American Association for the Advancement of Science," by G. A. Miller; "Some Surfaces Having a Family of Helices as One Set of Lines of Curvature," by Eva M. Smith; "Note on Enriques's Review of the Foundations of Geometry," by A. R. Schweitzer; "Notes"; "New Publications."

SPECIAL ARTICLES

A POSSIBLE ERROR IN THE ESTIMATES OF THE RATE OF GEOLOGIC DENUDATION[1]

THE presentation at the Baltimore meeting of the American Chemical Society of a paper by Dole and Stabler on the rapidity of geologic denudation recalls attention to a possible source of error in such estimates which has been already implied in the writings of Walther, Udden and other students of æolian geology. The peculiarly thorough and comprehensive figures of Dole and Stabler are deduced, as have been all previous ones, from the examination of river waters, and are based upon the assumption that all material which is removed from the land to the sea is carried in suspension or solution by outward-flowing water. Recent studies on the magnitude of æolian transport cast some doubt upon the validity of this assumption. It has become apparent that much surface material is moved from place to place by æolian action and that much of this transport is to be ascribed to the slow and unnoticed, but continuous, action of

[1] Published by permission of the Secretary of Agriculture.

ordinary winds. The winds are so ubiquitous and so incessantly in motion that their aggregate geologic work is by no means negligible, though it may be momentarily inappreciable. If the winds are constantly carrying material they must be carrying some of it to sea, and of this the major part will be deposited in the ocean and only a small fraction returned to the land. Land breezes are notoriously dusty, and that the winds blowing inward from the ocean are much more free from solid contamination is known, not only deductively and from general observation, but as the result of actual counts of the dust particles.[2]

Udden[3] has calculated on very conservative data that the transport capacity of the winds blowing outward from the Mississippi Basin is at least one thousand times greater than that of the river. This, of course, refers only to transport *capacity,* and no one imagines that the actual amounts of material moved are in the same ratio. The air, unlike the water, is seldom loaded to any considerable fraction of its capacity. It is evident, however, that if the wind performs only an infinitesimal part of the carriage for which it has the ability, its activity is nevertheless far too great to be neglected. Neither is the Mississippi Basin a region especially susceptible to æolian action. The immense amount of wind-borne material carried out of deserts is universally admitted, and the example of the sirocco dust which constantly leaves the Sahara for the Atlantic to the west and the Mediterranean to the north is universally familiar.

From the information at present available it is entirely impossible to estimate with accuracy the yearly rate of æolian removal or the resultant error in the calculations of the rapidity of denudation. It seems, however, not improbable that the error is of some moment and that the present estimates are too low in a not unimportant degree, even when their admittedly approximate character is taken into account. These conclusions derive added force from two recent papers by Thoulet[4] in which he records his conviction that a considerable fraction of the mud of the sea bottom is terrestrial dust borne to its position by winds and fallen through the overlying water in an approximately vertical path.

[2] Aitkin, *Trans. Roy. Soc. Edinb.*, 42: 486, 1902.

[3] *Jour. Geol.*, 2: 318–331, 1894.

[4] *Comptes Rendus*, 146: 1184–1186, 1346–1349, 1908.

E. E. Free

Bureau of Soils,
U. S. Department of Agriculture

THE AMERICAN SOCIETY OF ZOOLOGISTS

The regular triennial joint meeting of the Eastern and Central Branches of the American Society of Zoologists was held at the Johns Hopkins University, Baltimore, Md., on December 29, 30 and 31, 1908.

The following resolutions were adopted:

Resolved, That this society most urgently recommends to the Committee on Ways and Means, or other body having the matter in charge, that the present duty on scientific books published in English, and on scientific apparatus be removed.

Resolved, That, in the opinion of this society, the migratory birds of the United States should be properly protected by national laws, and that this society urges immediate consideration of the bill, introduced by Representative Weeks, now before Congress.

The officers elected were:

EASTERN BRANCH

President—Herbert S. Jennings, Johns Hopkins University.

Vice-president—H. V. Wilson, University of North Carolina.

Secretary-Treasurer—Lorande Loss Woodruff, Yale University.

Additional Member of Executive Committee—Maynard M. Metcalf, Oberlin College.

CENTRAL BRANCH

President—Edward A. Birge, University of Wisconsin.

Vice-president—Michael F. Guyer, University of Cincinnati.

Secretary-Treasurer—Charles Zeleny, University of Indiana.

The following papers were presented:

Diverse Races of Paramecium and their Relation to Selection and to Conjugation: H. S. Jennings, Johns Hopkins University.

"Wild" cultures of *Paramecium* were found to consist of many diverse races, which remain constant in relative mean size when propagated in "pure lines," by fission. Eight such differing "pure lines" were isolated and propagated side by side under the same conditions for many months. The smallest race had a mean length below 100 microns; the largest a mean length above 200 microns. Most existing races fall into two groups: (1) those with mean length above 170 microns; (2) those with mean below 140 microns. The former group corresponds to what has been described as the species *caudatum*, the latter to *aurelia*. A single race falling half-way between the two groups was found; such races are rare.

Within the pure race there is much variation due to environmental conditions and to growth, but such variations are not inherited. Large and small individuals of the same race produce progeny of the same mean size, so that the characteristics of the progeny depend on the fundamental constitution of the race, not on the individual peculiarities of the parent. It is not possible to produce by long continued selection diverse races from a single race.

The diverse races retain their relative sizes throughout the life cycle, including conjugation. Owing to the assortative mating described by Pearl, there is a tendency for the diverse races to remain isolated even when conjugation occurs.

The Reactions of Didinium nasutum with Special Reference to the Feeding Habits and the Functions of Trichocysts: S. O. MAST, Woman's College of Baltimore.

Light Reactions in Euglena and Stentor cœruleus: S. O. MAST, Woman's College of Baltimore.

Notes on Opalina: MAYNARD M. METCALF, Oberlin College.

A paper describing the phenomena to which these notes refer will appear in the *Archiv f. Protistenkunde*, Bd. XIII., Heft 3.

The Measurement of Relative Toxicity and of Differences of Physiological State by the Use of Protozoa: A. W. PETERS, University of Illinois.

Selection of Food in Stentor cœruleus: ASA A. SCHAEFFER, Johns Hopkins University.

From a capillary pipette, potato starch grains, particles of sand, bits of débris, *Euglena viridis*, *Phacus triqueter*, *Trachelomonas volvocina*, etc., were fed in mixed order, on to the disk of a *Stentor*. The path and fate of each particle was recorded. The starch, sand and débris were almost invariably rejected, while the organisms, either freshly killed or living, were invariably ingested. When the *Stentor* became more and more filled up, more and more of the organisms were rejected, until eventually all organisms, as well as all starch, sand, etc., were rejected.

In some experiments it was shown that some organisms are eaten while others are not; thus in a stream of *Euglena viridis* and *Trachelomonas volvocina*, fed in mixed order, although both kinds of organisms were eaten at the beginning of the experiment, the *Stentor* ate only *Euglena* in the latter part of the experiment, rejecting all *Trachelomonas* and also some *Euglena*.

Thus *Stentor* can "select" food particles from a stream containing food and non-food particles. Further, *Stentor* can "select" one kind of food from a mixture of several different kinds, such as *Euglena* from *Trachelomonas*, etc.; and it is highly probable that *Stentor*, when nearly replete, "selects" certain individuals to the exclusion of others, of the same species.

Selection can be explained upon purely objective grounds as determined by the action of the stimulus in the particle upon the ingesting mechanism (including the varying physiologic state) of *Stentor*.

Duration of the Cycle of Paramecium: LORANDE LOSS WOODRUFF, Yale University.

A culture of *Paramecium* has been carried on a varied culture medium for twenty months, during which time 930 generations have been attained. Conjugation has been prevented by the daily isolation of individuals, and no artificial stimulation has been employed. "Abnormal" physiological or morphological changes have not appeared in the specimens.

Effects of Centrifugal Force on the Organization and Development of the Eggs of Ascidians and Mollusks: E. G. CONKLIN, Princeton University.

The Organization of the Egg of a Medusa: E. G. CONKLIN, Princeton University.

The Oogenesis of Cumingia tellinoides (Conrad): H. E. JORDAN, University of Virginia.

The primary oocyte at the beginning of the growth period has a nucleus of three microns diameter. The nuclear reticulum is achromatic except for a large eccentric nucleolus. At slightly later stages chromatic masses appear in the nucleus and are generally arranged in pairs. Such pairs probably represent presynoptic bivalent chromosomes. The arrangement of the chromosomes indicates parasynapsis. Still later in the

growth period the chromosomes become aggregated into a mass and the latter assumes a more or less close connection with the nucleolus. Both nucleolus and chromosome-mass are typically close to the nuclear wall. Maturation proceeds to the metaphase in the ovarian egg. A single instance was observed where the mitosis had passed to anaphase. The later phases of maturation occur only after the egg is extruded and fertilized. The nucleolus disappears during the metaphase of the first maturation mitosis. It seems to contribute a small amount of chromatin to the chromosomes, after which its main bulk is resorbed by the cytoplasm. The nucleolus appears to be of the nature of reserve food material rather than a waste product.

The astral system of the first mitosis consists of a large, very chromatic centrosome surrounded by a homogeneous acroplasmic centrosphere which is bounded by a "microsome circle" and an outlying astrosphere. Between metaphase and anaphase in the free eggs the centrosome disappears. The centrosphere of the second polar spindle, as also of the fertilization and early segmentation spindles, is achromatic and granular. The centrosome appears to be merely an accompaniment of the astral system, representing a transient metabolic phase of maturation coincident with the formation of the first polar spindle. The reduced number of chromosomes is eighteen. The second mitosis segments univalent chromosomes transversely and is the reducing division.

The Germ-cell Determinants of Chrysomelid Beetles: R. W. Hegner, University of Michigan.

The Germ-cell Determinants.—This paper is based on the study of the lineage of the germ-cells of *Calligrapha multipunctata* and three other chrysomelid beetles. At the time of laying a disc-shaped mass of granules is present at the posterior end of the egg suspended in the peripheral layer of cytoplasm. I have called this disc the "pole-disc" and the granules the "germ-cell determinants." The cleavage products in the eggs of these beetles migrate through the central yolk mass to the periphery, where they produce the blastoderm. Those cleavage products that come in contact with the germ-cell determinants do not produce blastoderm cells, but continue their migration until they are entirely separated from the egg. These cells take with them practically all of the germ-cell determinants. At first there are 16 of these cells, but they soon divide twice, the final number being 64. These are the primordial germ-cells. They can be traced back into the embryo, where by amœboid movements they migrate half to either side of the germ-band. Later they produce the germ-glands. The sexes can be distinguished during the embryonic period by the shape of the germ-glands.

The Results of Removing the Germ-cell Determinants.—A number of fresh eggs were punctured and the germ-cell determinants allowed to flow out. These eggs developed into embryos or larvæ which contained no germ-cells.

The Sexual Differences of the Chromosome Groups in Pyrrochoris and Syromastes: Edmund B. Wilson, Columbia University.

The facts in *Pyrrochoris* and *Syromastes* have been supposed to contradict the general rule, established for many other forms, that those spermatozoa which receive the accessory chromosome are female-producing, the others male-producing; for in both cases the two sexes have been described as having the same number of chromosomes—24 in *Pyrrochoris* and 22 in *Syromastes*. A reexamination of both sexes in the two forms has proved that they form no exception to the rule, previously published accounts being erroneous in respect to the male of *Pyrrochoris* and the female of *Syromastes*.

In *Pyrrochoris* the male number is not 24, but 23, the odd or accessory chromosome being the largest of the chromosomes. Half the spermatozoa receive this chromosome and half fail to receive it, the former class having 12 chromosomes and the latter 11. The female groups contain 24 chromosomes, of which two are of the same relative size as the single accessory of the male. *Pyrrochoris*, therefore, conforms precisely to the usual type shown in *Anasa*, *Protenor*, etc.

In *Syromastes* the male number is 22 (as described by Gross), but the female number is not 22, but 24, as was first inferred by the writer from the condition seen in the male only. Direct observation has now proved that this inference was correct. *Syromastes* constitutes a new type in which there are two accessory chromosomes (the second and third smallest of the spermatogonial groups) which pass together, as a bivalent, into half the spermatozoa. These spermatozoa receive 12 chromosomes, the others 10, and the somatic numbers of the sexes prove that the former class are female-producing, the latter male-producing. (Demonstrations by photographs.)

Some New Types of Chromosome Distribution and Their Relation to Sex: Fernandus Payne, Columbia University.

A study of *Gelastocoris* and the Reduviidæ has revealed several new types of chromosome distribution.

There is present in *Diplodus* and several other species of the Reduviidæ a pair of idiochromosomes, which in the new types is replaced by a compound group. Each of these groups as a whole behaves as a pair of idiochromosomes, the small idiochromosome being represented by one element and the large idiochromosome by a multiple group. In *Fitchia* the multiple group consists of two; in *Prionidus*, three; in *Gelastocoris*, four; and in *Acholla multispinosa* (identified by E. P. Van Duzee) of five chromosomes. This multiple group in the second maturation division always passes to one pole and the single element the other, thus producing in each case two classes of spermatozoa.

The male and female chromosome groups are, respectively, 27 and 28 in *Fitchia;* 26 and 28 in *Prionidus;* 35 and 38 in *Gelastocoris;* and 26 and 30 in *Acholla*. Judging from these numerical relations the two classes of spermatozoa must be male and female producing.

It seems very probable that the new types have arisen from the idiochromosome type by the large idiochromosome breaking up into a number of elements.

These new types of chromosome distribution offer nothing new to the theory of sex-production as advocated by Wilson ('06) and Stevens ('06), but they are perfectly consistent with it.

In *Acholla multispinosa*, although the female has the larger number of chromosomes, the male seems to have the greater quantity of chromatin.

Sex Determination and Parthenogenesis in Phylloxerans and Aphids: T. H. MORGAN, Columbia University. (See SCIENCE, 1909.)

Maturation, Fertilization and Cleavage of Tubularia crocea and Pennaria tiarella: GEO. T. HARGITT.

During the period between the end of the growth of the egg and the formation of the polar bodies the large nucleolus disappears, a concentration of the chromatin occurs, the nucleus decreases in size and becomes ovoid in shape. At the pointed outer end only, in the nucleus of *Tubularia*, an aster without a centrosome is usually present for a considerable time. The fate of this aster is not known.

Polar bodies are formed by mitosis. No asters or centrosomes are present in the first polar spindle, so far the only one actually observed. In *Tubularia* two polar bodies are formed. In the first polar spindle of *Pennaria* apparently only about one half of the somatic number of chromosomes is present, though the actual number is still uncertain. In *Pennaria* the time of formation of the polar bodies varies considerably, some eggs passing through this stage just before fertilization, and some several hours before the liberation of the eggs from the medusæ.

In *Pennaria* spermatozoa may enter the egg at any point, though usually close to the position of the egg nucleus. The transformation into the sperm nucleus takes place just within the edge of the egg, before migration toward the egg nucleus begins. One or both of the pronuclei are often multi-vesiculate, at least up to the time of conjugation. No asters or radiations of any sort are present during the conjugation of the pronuclei.

Segmentation seems to be always by mitosis and cytoplasmic division is often delayed until several nuclei are present.

Early Development of the Spider's Egg: THOS. H. MONTGOMERY, JR.

The gastrulation takes place from an anterior and a posterior cumulus, and from the margins of the germ disc; vitellocytes form at all these regions, mesoblast and entoblast only from the anterior cumulus. The vitellocytes take no part in producing the intestine. Entoblast develops only in the abdomen. The blood cells arise from the extraembryonic ectoblast, and migrate secondarily into the embryo. One pair of cœlomic sacs develops anterior to the mouth, and the rostral prominences are to be considered prestomial appendages of this head segment; there is no evidence of other preoral appendages. Pulmonary lamellæ appear before the pulmonary appendages invaginate, and upon these. The supraœsophageal ganglion is a fusion of one pair of cerebral ridges, and a pair of antero-lateral and a pair of postero-lateral vesicles, all local differentiations of the single head lobe.

The Formation of the Mouth Opening and the Limits of the Ectoderm and Entoderm in the Mouth of Amphibians: J. B. JOHNSTON.

The Post-anal Gut and its Relation to the Doctrine of Recapitulation: BASHFORD DEAN, Columbia University.

It was pointed out that the general value of the "biogenetic law," now often discredited, might be tested by paleontological documents, even in the case of structures whose nature rendered them poor subjects for fossilization. This Dr. Dean illustrated in the case of the post-anal gut in the embryos of fishes, giving reasons to show that the post-

anal was a functional gut in the adult of certain Devonian sharks. In these forms (Cladoselachids) the anal fin was paired, its elements converging at the base of the tail, where the cloaca was accordingly located. The sub-caudal position of the cloaca is, moreover, indicated by the position of the kidneys. These are now known, both by macroscopic and histological characters in these fossils to have continued behind the ventral fins and converged near the tail.

The Cause of Pulsation in Scyphomedusæ: Alfred Goldsborough Mayer, Carnegie Institution of Washington.

In the case of *Cassiopea xamachana* the sodium chloride of the sea water is a powerful stimulant to the nervous system, but its tendency in this direction is exactly offset and counteracted by the inhibiting influences of the magnesium, calcium and potassium. Thus the sea water as a whole is a balanced fluid, and neither stimulates nor inhibits the pulsation of the medusa.

The stimulus which causes pulsation is due to a slight but constantly maintained excess of sodium chloride over and above its concentration in the sea water. This excess of sodium chloride is engendered in the distal endodermal cells of the marginal sense-organs, which constantly give rise to sodium oxalate. This oxalate precipitates the calcium chloride and sulphate which enter the sense-club from the surrounding sea water, and forms the calcic oxalate crystals of the sense-club, thus setting free sodium chloride and sulphate, which act as powerful nervous stimulants to which the nervous elements respond periodically.

The stimulus-producing pulsation is thus wholly internal, not due to external agencies. It has been commonly supposed that the crystalline concretions in the sense-clubs of scyphomedusæ were calcium carbonate, but I find upon chemical analysis that they are oxalates.

The Sense of Hearing in the Dogfish: G. H. Parker, Harvard University.

If the side of a large wooden aquarium in which a dogfish (*Mustelus canis*) is swimming quietly is struck a vigorous blow, the dogfish will react by a quivering motion, especially of the posterior edges of the pectoral fins. By the use of a heavy pendulum the momentum with which a given blow was struck could be determined. The momentum of the minimum blow to which normal fishes reacted was arbitrarily called unity. After the eighth nerves were cut a blow with a momentum three or four times that just mentioned was needed to produce a reaction. This response was believed to be due to the mechanical stimulation of the skin. After the skin of a normal fish had been rendered insensitive by cutting the fifth, seventh and lateral line nerves, and by cocaining the pectoral regions, a step not taken in previous experiments, the fish was found to be as sensitive to sounds as a normal fish is. This sensitiveness entirely disappeared when in addition to the operations already carried out on the fish, the eighth nerves were cut. Sounds affect both the skin and the ears of the dogfish and the latter organs are the more sensitive of the two.

Regulation in the Morphogenetic Activity of the Oviduct of the Hen: Raymond Pearl, Maine Agricultural Experiment Station.

This paper gives an account of a case in which a gradual change in the shape of eggs successively laid by the same bird occurred. This change in the shape of the eggs is (1) referable to a change in the activity of the oviduct, (2) definitely progressive and (3) regulatory in character, since it proceeds from the abnormal to the normal. The first egg laid by a particular Barred Plymouth Rock pullet (No. 183) was strikingly abnormal in shape (long and narrow). Every egg laid by this bird was saved and measured. As eggs were successively laid there was a gradual change in shape from the abnormal condition found in the first eggs to a substantially normal condition.

The change in the shape of the eggs was found to follow a logarithmic curve, of the type seen in growth curves.

The Nature of the Stimulus which Causes a Shell to be Formed on a Bird's Egg: Raymond Pearl and Frank M. Surface, Maine Agricultural Experiment Station.

This investigation was undertaken to determine precisely what is the nature of the stimulus which excites the reflex activity of the shell-secreting glands of the oviduct in birds. These possibilities were to be considered:

1. That the stimulus is mechanical, and arises from the presence of a soft body (the egg) within the "uterus" or "shell gland."

2. That the stimulus is chemical in nature.

3. That the activity of the shell-secreting apparatus is controlled directly by the functioning of other parts of the reproductive system.

If shell formation is caused from the mechanical stimulation of the "shell gland" by the egg it would be expected that any foreign body introduced into that portion of the oviduct would have a shell formed around it. It was found to be impossible to introduce a foreign body of any size

from the outside into the "shell gland" without resort to such violent methods as to make the conditions entirely abnormal. Further, the foreign body introduced should approximate to the consistency of the egg, so that the stimulus may be physiological rather than traumatic.

To realize these conditions the following operation was performed on hens. The oviduct was transected 1 or 2 cm. above the upper end of the "shell gland." The anterior portion of the oviduct was then ligated. The intestine was transected just anterior to the cloaca and the cloacal wall repaired by inversion of the stump and a purse string suture. Then the cut end of the intestine was anastomosed to the cut end of the oviduct ("shell gland"). As a result of this operation the feces must necessarily pass through the "shell gland" on the way to the cloaca. *In hens on which this operation has been performed a calcareous shell is deposited on the feces during their passage through the shell gland.* The results obtained from these experiments are held to warrant the following conclusions:

1. The stimulus which sets the shell-secreting glands of the fowl's oviduct into activity is mechanical rather than chemical in nature.

2. The formation of a shell on the hen's egg is brought about by a strictly local reflex, and is not immediately dependent upon the activity of other portions of the reproductive system (nervous impulse of hormone formation).

Experimental Control of Fission in Planaria: C. M. CHILD, University of Chicago.

The Artificial Production and the Development of One-eyed Monsters: CHARLES R. STOCKARD, Cornell Medical School.

The eggs of the fish, *Fundulus heteroclitus*, give rise to a large percentage of cyclopean embryos when subjected during their development to solutions of magnesium salts in sea water. These one-eyed embryos hatch and many of them swim in a perfectly normal manner, darting back and forth to avoid objects placed in their field of vision as readily as do two-eyed individuals.

The cyclopean fish is entirely comparable to the one-eyed human monsters. Both have a median eye more or less double in structure. The nose in the human cyclops is a proboscis-like mass above the eye. The nasal pits in the "magnesium embryos" are sometimes united and sometimes separate, but the mouth hangs ventrally as a proboscis-like organ, suggesting in form the nose in mammalian cyclopia.

The fish embryos exhibit various degrees of the cyclopean defect from eyes unusually close together to approximated eyes, double eyes and finally a single median eye. The different conditions are exhibited from the earliest appearance of the optic outpushings and in no case was cyclopia due to a union or fusion of the two eye components after they had originated separately.

A second type of monster, "monstrum monophthalmicum asymmetricum," was also common in the magnesium solutions. These individuals have one perfect eye of the normal pair but the other is either small, poorly represented or entirely absent. This condition is also present from the first appearance of eye structures and is not due to degeneration or arrest of development.

Both types of monsters often form well-differentiated crystalline lenses independently of a stimulus from the optic-cup.

The experiments conclusively prove that developing eggs may be induced to form cyclopean monsters by external influences which do not mechanically injure certain eye regions. Therefore, cyclopean monsters in nature are probably not due to germinal variations, but are far more likely the result of some unusual external influence during development.

Cosmobia; a Theory Concerning Certain Types of Monsters: H. H. WILDER, Smith College.

The readiness with which the types of double monsters may be arranged in related series has been recognized for some time, and this phase of the subject has been recently revived. To illustrate this, the main types of the Janus series were presented, beginning with a symmetrical Janus, passing through the different stages of gnathopagus, thoracopagus, etc., and ending with a type of duplicate twins in which the placenta alone is common, the other parts distinct. This leads to the definition of such twins as double monsters in which the common parts are confined to the extra-embryonal structures. These are lost at birth, freeing the components. The diprosopus group was treated in the same way. Attention was then called to the fact that in symmetrical monsters that are less than unity the doubled or compound parts, eyes, limbs, etc., are indistinguishable from those that are found in monsters that are on the other side of the normal, *i. e.*, the diplopagi. As a conclusion from this it seems that both classes of monsters are due to the same or a similar cause, and that normal individuals also belong in the same general series. To such individuals, both less and more than unity, including also normal forms, the term "*cosmobia*,"

or "orderly beings," may be applied. These forms are held to be due to some fundamental cause inherent in the germ itself, that is, in the egg or the embryo in the early cleavage stages, and must be carefully distinguished from all deformities or other monstrosities that are due to external or later developing causes, not germinal.

A Further Contribution on the Regenerative Power of the Somatic Cells of Sponges after Removal from the Parent: H. V. Wilson, University of North Carolina.

I have described (*Journ. Exper. Zool.*, Vol. V., No. 2) a method by which sponges, more particularly *Microciona*, may be made to regenerate from somatic cells. The sponge is cut into pieces and the pieces are strained under pressure through bolting cloth. The separated cells of the body pass through the pores of the cloth and collect as a sediment on the bottom of the dish. The sediment may be drawn up into a pipette and strewn over a glass slide or other object. The cells combine, forming a plasmodial structure which gradually differentiates into a functional sponge having pores, oscula, flagellated chambers and canals. It remained doubtful whether sponges grown in this way would live long enough to develop the characteristic skeleton. The experiments with *Microciona* have been repeated, and the regenerated sponges kept for two months. The characteristic species-skeleton was differentiated. Reproductive elements and embryos were also formed. The sponges appear to be healthy and to differ in no wise from normal specimens.

The Effects of Certain Paralyzing Agents on Form Regulation: C. M. Child, University of Chicago.

The Rate of Regeneration and the Effect of New Tissue on the Old Body: Charles R. Stockard, Cornell Medical School.

Regeneration takes place equally fast from the disk of *Cassiopea xamachana*, whether it be in periodic pulsation or in a condition of rest.

Peripheral pieces of the disk cut in sundry patterns show decided regulatory ability and tend to assume the original circular shape of the entire disk in the most direct way that their forms will permit. The attainment of the circular form inhibits the process of regeneration in the pieces, yet regeneration will continue for a much longer time if such shapes be prevented.

The rate of regeneration from a peripheral cut on the *Cassiopea* disk is faster the nearer the disk center the cut is made. In the brittle-stars *Ophiocoma riisei* and *O. echinata* new arms regenerate faster as the old arms are cut off nearer their base of attachment to the body-disk.

The rate of regeneration does not bear a definite relation to the extent of injury in all animal species. The medusa, *Cassiopea*, regenerates each oral-arm at a rate which is independent of the degree of injury when replacing either one, two, four or six of its arms. If, however, eight arms are amputated each arm regenerates at a rate significantly faster than the rate when injured to any less degree. *Ophiocoma riisei* regenerates one, two, three, four or all five of its arms at rates not significantly different. *O. echinata* grows individual arms fastest when only a single arm is regenerating and successively slower when two, three, four and five arms are being replaced.

Regenerating tissue possesses an excessive capacity for the absorption of nutriment and may do so even to the detriment of the old body tissue. The unfed disk of *Cassiopea* decreases in size in direct relation to the number of regenerating arms. Although the disk regenerating eight new arms is growing them at the most rapid rate, it is, nevertheless, decreasing in size most rapidly. In growing specimens of *Ophiocoma riisei* the increase in size is slower in those individuals regenerating many arms as compared with others regenerating fewer. *O. echinata* regenerates each arm faster when only a few arms are cut, such individuals increase in size at about the same rate as do those which are regenerating each arm slower although more arms are being replaced.

Successive Regenerations; New Observations and General Discussion: Charles Zeleny, University of Indiana.

The Physiology of Nematocysts: O. C. Glaser and C. M. Sparrow, University of Michigan.

Nematocysts, isolated by digestion and maceration, can be discharged by raising their internal pressure.

The pressure needed to bring about explosion varies with conditions. It may be artificially altered by immersion in various liquids, a fact which explains why the nematocysts of eolids explode in sea water, whereas those freshly isolated from cœlenterates, do not.

When stimulated, the nematocyte is a factor in the discharge of the thread. It is not possible to show that stimulation of the mother-cell results from all the conditions under which explosion occurs. Nevertheless, it is probably true that when a nematocyst discharges as the result of conditions normal to the lives of cœlenterates, it

does so because the nematocyte enclosing it has been stimulated.

Elevation of the internal pressure of the nematocyst may be the cause of normal explosion in cœlenterates. If we suppose that stimulation of the nematocyte inaugurates changes which result in lowering the concentration of the cell contents surrounding the nematocysts, the result can be understood. If, as is not unlikely, heat is liberated, the matter becomes still easier, for either dilution or heat can separately bring about the instantaneous discharge of freshly isolated nematocysts.

Distortion brings about the discharge of isolated nematocysts, but uniform external pressure is useless. It might be supposed that inside the nematocyte there is a mechanism capable of squeezing the nematocyst. Such a mechanism is at present purely hypothetical, and, it seems to me, not needed to explain the facts.

The threads of nematocysts, contrary assertions notwithstanding, are able to penetrate the tissues of other animals, but in order to do so must make their punctures during the period of highest speed, viz., at the beginning of the eversion. This observation renders unnecessary the assumption of a "Reizgift," made in order to account for the nettling sensation produced by nematocysts.

The Behavior of the Cuckoo: FRANCIS H. HERRICK, Western Reserve University.

There is no conclusive evidence to show that the American black and yellow-billed cuckoos are either losing their nesting instincts, or that once having lost them they have been regained. Possibly a lack of attunement of the cyclical instincts occasionally seen in all birds, and rather more frequent in these cuckoos, may have been the starting point of the "parasitic" habit of *Cuculus canorus* and related old-world genera. Parental instinct is strong in the American cuckoos, and their nests, though frail, are well adapted to their purposes.

The eggs are commonly laid and hatched on alternate days, but nest-life is not unduly prolonged in consequence, this apparent extension being counterbalanced by the development of a remarkable climbing instinct in the young and a premature desertion of the nest. In the life and behavior of the young cuckoo three stages are clearly distinguished: (1) period of infancy, when their black skin is sprinkled with snow-white "hairs" or rudimentary down; (2) complete quill stage on the sixth day and (3) the climbing stage when on the seventh day the nest is summarily deserted by each bird in order of development, and marked by a sudden though incomplete transition to the feather state.

The cuckoo is remarkably enduring from birth, and its grasping reflex most striking. When born it can support its own weight with one foot or with a single toe. Later with feet and bill it easily raises itself upon any support. At the close of the quill-stage fear is present, and there is perfect association with the nest and parent. The feather tubes now begin to give way at their base, especially over the breast and abdomen, and in the energetic practise of the preening instinct the tubes are combed off by the mouthful and in a few hours. The tubes of the flight-feathers and those of the back break away centripetally, so as to expose the shafts gradually as in other birds. When the bird climbs out of the nest early on the seventh day it is only half fledged, quills still showing on head, neck and back. In the climbing stage, when they remain in bushes for upwards of ten days, their behavior suggests that of the young hoatzin.

In serving the large caterpillars and larvæ which are brought to the nest by both parents, the insect is placed in the *mouth*, and not in the throat, as in nearly all birds observed, and is held there for, it may be, five minutes, neither bird moving, or until the swallowing reflex is started. The last bird in the nest is apt to be deserted, parental instinct being diverted and satisfied by the attentions which those already in the bush demand.

Phototaxis in Fiddler Crabs: S. J. HOLMES, University of Wisconsin.

The Reactions of Amphibians to Light: A. S. PEARSE, University of Michigan.

Ten representative species of amphibians were tested and all of them showed marked phototropic reactions. In most instances these species gave the usual responses after the eyes had been removed, the skin serving as a photoreceptor. When a toad was stimulated through only one eye by light from in front or when the skin of an eyeless toad was subjected to unilateral stimulation by light from above, the resulting locomotion was toward the stimulated side and not toward the source of illumination. Such responses are, therefore, brought about by bilateral differences in stimulation and not by any orienting influence due to the direction of the light rays. Previous conditions of light stimulation had no apparent effect on the photic responses of the toad.

Although the rays toward the violet end of the

spectrum produced the largest number of positive responses from normal salientians, no such potency was manifested by the shorter rays when eyeless individuals were tested. In the latter case all rays were equally effective in inducing reactions.

Eyeless toads which gave marked phototropic responses were indifferent to radiant heat of an energy value equivalent to that of the light used. It may, therefore, be affirmed that thermo- and photo-reception are distinct processes in the toad's skin.

Spinal amphibians gave no photic responses, but light reactions were induced in animals which had lost the portions of the brain anterior to the metencephalon.

The Receptiveness of the Vertebrate Skin for Light and the Origin of the Vertebrate Eye: G. H. Parker, Harvard University.

In the last few years it has been shown that numerous amphibians will respond to light by moving either toward it or away from it even after their eyes have been removed. The receptive organ in this response is the skin. Tests of a like kind have been made on only a very few fishes. It is highly probable that the skin of *Amphioxus* and of *Fundulus* is not sensitive to light and it is very certain that that of ammocœtes is highly sensitive to this stimulus. To ascertain the condition in other fishes, blind individuals of nine species of marine forms were tested by throwing upon the side of the body a beam of concentrated sunlight. The species tested were *Mustelus canis, Anguilla chrysypa, Fundulus heteroclitus, Stenotomus chrysops, Tautogolabrus adspersus, Tautoga onitis, Chilomycterus schœpfi, Opsanus tau* and *Microgadus tomcod.* In no instance was any reaction observed. As all these species and *Amphioxus* are marine and the amphibians and ammocœtes are inhabitants of fresh water, it seems as though fresh water was favorable for the development of integumentary sensitiveness to light and salt water inimical to this. The condition may be just the reverse of animal phosphorescence which is common in the sea, but unknown in fresh water. If further investigation should prove that no marine vertebrate has an integument sensitive to light, such theories of the origin of the vertebrate eyes as derive it from the skin would be rendered highly improbable.

Methods of Studying Color Vision in Animals: Robert M. Yerkes, Harvard University.

There are three general methods of obtaining chromatic stimuli: the reflection method (absorption and reflection by colored papers, cloths, pigments), the transmission method (absorption and transmission by colored glasses, gelatines, solutions) and the refraction method (dispersion spectra by means of prism).

Of these three methods, the first is purely qualitative, and has as its chief recommendation the naturalness of its stimuli. The second method is both qualitative and quantitative, but it fails to give the experimenter that degree of control of the wave-length of his stimulus which is demanded by the thoroughgoing and rigidly scientific quantitative investigation. The third method promises to meet the chief requirements of quantitative work.

These requirements are that the method shall enable the experimenter (1) to obtain stimuli of any desired wave-length or range of wave-lengths, (2) to measure the wave-length of the stimuli accurately and with reasonable facility (preferably by means of a calibrated slit mechanism), (3) to control the intensity of the stimuli perfectly by (*a*) moving the source of light, or (*b*) changing the size of the beam, or (*c*) interrupting the beam, or by each of these methods in turn, (4) to measure the intensity of stimuli accurately and easily both photometrically and radiometrically (preferably by means of a calibrated mechanism), (5) to present chromatic stimuli to his subject independent of the secondary criteria of discrimination: size, form, distance, position, texture of surface and temperature.

Investigations now in progress in the psychological laboratories of Harvard and Johns Hopkins universities, under the direction of the committee on standardization of tests appointed by the American Psychological Association, promise to provide us soon with an admirable method for the study of color vision in animals. A report of the results of these investigations is now in course of preparation by R. M. Yerkes, J. B. Watson and E. D. Congdon.

An Account of Experiments for Determining the Complete Life History of Gasterostomum gracilescens: D. H. Tennent, Bryn Mawr College.

In previous work[1] the writer demonstrated the life history of *Gasterostomum gracilescens* with the exception of infection of the oyster.

During the summer of 1908 I obtained *Lepisosteus osseus* from the region of oyster beds in Newport River, North Carolina, and found that they contained *Gasterostomum* in abundance. The fæces of the fish were found to contain *Gasterostomum* embryos.

[1] *Quart. Jour. Mic. Sci.*, Vol. 49, pp. 635–690.

A mixture of fæces in water was injected between the valves of uninfected oysters and these oysters were placed in a wire box in the water. After one month these were taken up and examined. Of twenty-six oysters thus treated twenty-two were alive and contained sporocysts of *Gasterostomum* immediately outside of the stomach wall.

This experiment completes the demonstration of the life history as follows:

1. Adult *Gasterostomum* in *Lepisosteus osseus* and in *Belone vulgaris*.

2. Sporocysts and cercariæ (*Bucephalus*) in the oyster.

3. Free immature and encysted *Gasterostomum* in *Menidia* and other small fishes which serve as food for *Lepisosteus* and *Belone*.

The work also indicates the probable identity of *Bucephalus polymorphus*, found in fresh-water mussels, and *Bucephalus haimeanus*, found in various marine lamellibranchs.

Embryonic Variability in Echinoids: D. H. TENNENT, Bryn Mawr College.

Study of variations of plutei of same age, but from eggs of different females.

Comparison of fed with unfed plutei.

Study of plutei obtained from eggs of one female which were divided into several portions and each portion fertilized with sperm from a different male.

Variation in the Tentacles of Hydra viridis: ALBERT M. REESE, West Virginia University.

These investigations sought to show (1) the variation in the number of tentacles, (2) the relation between the original number of tentacles and the number regenerated after decapitation and (3) the relation between the number of tentacles of a bud and the number possessed by the parent.

Parke states that the number of tentacles varies from four to eleven; and Rand says that in one hundred and fifty *Hydras* only three had nine tentacles, while about 12 per cent. had eight tentacles.

In the six hundred *Hydras* here studied the tentacles varied in number from four to twelve. Only four individuals with the greater number of tentacles were found. About 54 per cent. of the *Hydras* had eight tentacles, 24 per cent. had seven tentacles, and 15 per cent. had nine tentacles. The other numbers between four and twelve were represented by small percentages.

Even in different parts of the same twenty-foot aquarium the average number of tentacles varied, although the conditions were, apparently, exactly the same.

As has been noted before, the number of tentacles generally increases with the size and the age of the *Hydra*, though, under unfavorable conditions, the number may decrease with age.

As has been stated by former workers, the number of tentacles regenerated by a decapitated individual is nearly always less than the original number possessed by the *Hydra*. The average number of regenerated tentacles for seven-tentacled *Hydras* was 5.73, for eight-tentacled *Hydras* it was 6.47.

Parke states that the number of tentacles on buds varies from four to six, and is always less than the number possessed by the parent. In the *Hydras* here studied the buds had from six to nine tentacles, and in only 50 per cent. of these cases were there less tentacles upon the bud than upon the parent. In 37.5 per cent. of the budding *Hydras* examined the number of tentacles of bud and parent was the same, and in the remaining 12.5 per cent. of cases the bud had actually more tentacles than the parent.

A Report on the First Forty-three Generations of an Experiment concerning the Effects of Disuse: F. E. LUTZ.

The fly, *Drosophila ampelophila*, was bred for more than forty-three generations under conditions which prevented the use of the wings. There was no indication of any degeneration either in the absolute or relative size of the wing or in the venation.

Darwin's Case of Reversion in Poultry: C. B. DAVENPORT, Cold Spring Harbor, N. Y.

The cross between a black Spanish cock and white Silkie hen (an albino) produces black chicks, of which the cocks gain some red in the plumage of those feathers that are red in the jungle fowl. Darwin called this reversion. The second hybrid generation reveals the full story. Typically game-colored males and females appear in this generation. The whole matter is explained on the theory that the Spanish contains the factors: color factor, C; jungle fowl color pattern, J; and extra black coat, N; whereas C and N are absent in the Silkie. In the second hybrid generation theory calls for nine blacks to four whites and three games and this proportion is actually obtained.

A Substitute for the Theory of Warning Coloration: JACOB REIGHARD, University of Michigan.

Many of the coral-reef fishes of the Tortugas region are very conspicuous in their natural en-

vironment, as shown by photographs taken by a submerged camera.

The conspicuousness is of the sort typical of warningly colored insects and is often associated with formidable means of defense.

The conspicuousness is not due to secondary sexual coloration.

These fishes do not show aggressive resemblance and such resemblance is unnecessary for them, since their food consists chiefly of fixed invertebrates.

They do not show protective resemblance and have no need of it, since the coral-reef habitat affords them ample protection from their enemies.

Their conspicuousness is not an instance of warning coloration, since they are readily eaten by the commonest piscivorous fish of the region (*Lutianus griseus*), when removed from the reefs, although this fish possesses color vision, forms associations readily and retains these associations for a considerable time, and has therefore the qualities which would enable it to take advantage of warning coloration in its food.

The conspicuousness of the coral-reef fishes has therefore not arisen through selection of any sort, but is an expression of the action of internal forces (race tendency), in the absence of counteracting selection.

The disagreeable qualities of warningly colored insects is universally held to have been present before these insects became conspicuous. They therefore served at the start to inhibit the attacks of vertebrate foes and thus rendered protective coloration unnecessary for such insects.

The nature of their food has rendered aggressive coloration unnecessary to warningly colored insects.

The conspicuous colors of warningly colored insects have therefore arisen in the absence of selection, under immunity from selection. They are to be attributed to the action of internal forces unchecked by selection.

Other conditions than inedibility may so limit the attacks of vertebrate foes on insects (and other animals) as to render them free from selection from this source and wherever, in such cases, the nature of the food renders aggressive coloration unnecessary the insects are immune from the action of selection and free to develop conspicuousness. Inaccessibility may thus condition conspicuousness, and probably does so in the case of many edible butterflies.

The theory of immunity coloration is proposed as a substitute for the theory of warning coloration, while at the same time it covers certain cases not covered by the theory of warning coloration. Immunity coloration is defined as follows: "Coloration, not sexually dimorphic, which renders an organism in its natural environment conspicuous to vertebrates; which has no selective value, since it does not aid the organism in escaping vertebrate enemies by concealment (protective coloration), nor in approaching its accustomed invertebrate prey (aggressive coloration), and when associated with disagreeable qualities is unnecessary as a warning to vertebrate foes of the existence of such qualities (warning coloration); it is conceived to have arisen through internal forces under immunity of the organism from selection acting on its color characters." The exclusion of sexually dimorphic characters from the definition is provisional.

The Partulæ of the Society Islands, and the Problems of Distribution and Isolation: H. E. Crampton, Columbia University.

The survey of the islands of the Society Group of Polynesia was completed during the years 1907 and 1908, and the results have made it possible to offer relatively final statements regarding the variation and distribution of the species of *Partula* that occur in the group. Each island possesses characteristic forms, that with two exceptions are absent from other islands. The two peaks of Tahiti contain nearly similar forms; the two separated halves of Huaheine have the same species, although these exhibit more differences than the species of Greater and Lesser Tahiti; Tahaa and Raiatea are wider apart, although they have the same encircling reef, and their species are far more differentiated; finally, Borabora and Moorea possess unique forms, in correspondence with their total isolation from other islands.

A comparison of the valley faunas in any and all islands reveals a similar relation between geographical separation and racial divergence, and all the islands agree in demonstrating this correspondence. Evidence was presented showing that environmental influences can not be regarded as the immediate factors for racial differentiation, and that mutation has played a large if not an exclusive part in the process. The rôle of natural selection is restricted to a purely negative part.

The Experimental Modification and Control of the Behavior of Characters in Crossing: W. L. Tower, University of Chicago.

A Theory of the Modification and Origin of Characters in Animals: W. L. Tower, University of Chicago.

Color Inheritance in Crosses Between the Black Rat (Mus rattus) and the Roof Rat (Mus alexandrinus): T. H. MORGAN, Columbia University. (See *American Naturalist*, 1909.)

Some Methods and Results of Pigeon Breeding at the Rhode Island Experiment Station: L. J. COLE, Yale University.

Preliminary Statistics on the Nidification and the Proportions of the Sexes in Pigeons: L. J. COLE, Yale University.

The Inheritance of Egg-producing Ability (Fecundity) in the Domestic Fowl: RAYMOND PEARL and FRANK M. SURFACE, Maine Agricultural Experiment Station.

The data discussed in this paper were obtained from two lines of work. The first of these was an experiment in which for a period of nine years hens have been selected for high egg production. No hens were used as breeders whose production in the pullet year had not been 150 or more eggs. The cockerels used were, after the first year of the experiment, invariably the sons of mothers producing 200 or more eggs in their pullet year.

The second source of data was an experiment in which the inheritance of egg production from mother to daughter was directly measured. Records of the pullet year egg production of 250 daughters of hens laying 200 or more eggs in *their* (the mothers') pullet year were obtained.

Certain of the most important results obtained may be summarily stated as follows:

1. Selection for high egg production carried on for nine consecutive years did not lead to any increase in the average production of the flocks.

2. There was no decrease in variability in egg production as a result of this selection.

3. The present data give no evidence that there is a sensible correlation between mother and daughter in respect to egg production, or that egg-producing ability (fecundity) is sensibly inherited.

4. In this experiment the daughters of "200-egg" hens did not exhibit, when kept under the same environmental conditions, such a high average egg production as did pullets of the same age which were the daughters of birds whose production was less than 200 eggs per year.

5. The daughters of "200-egg" hens were not less variable in respect to egg production than were similar birds whose mothers were not so closely selected.

Color Changes of Ocypoda arenaria: R. P. COWLES, Johns Hopkins University.

Under certain conditions a dark color pattern can be distinctly seen through the carapace of *Ocypoda arenaria;* under other conditions this pattern disappears.

Many experiments were performed to test the effect of intensity of light, degree of temperature, mechanical and chemical stimuli. It was found that the first two factors determined the appearance and the disappearance of the color pattern.

In direct and diffuse sunlight when the temperature is kept low the pattern is visible, but when the temperature is high the pattern disappears.

In the absence of light at low medium and high temperature the pattern fails to appear.

Of the two factors, intensity of light and degree of temperature, the former is the more important.

A Gynandromorphous Crayfish: E. A. ANDREWS, Johns Hopkins University.

A specimen of *Cambarus affinis* proves upon study to be an immature male with a few external sex organs that should appear only upon the female.

This gynandromorph, or individual with a mixture of organs normally found upon two individuals, male and female, has a normal testis with no sign of ovogenesis, and two normal, but little developed deferent ducts and the two normal male papillæ at the bases of the fifth thoracic legs. Moreover, the limbs of the first and the second abdominal somites are as in a normal young male and the hooks of the third thoracic legs are normal.

On the other hand, the third thoracic legs bear two elliptical openings that closely imitate the openings of oviducts. These openings are mere blind cuticular structures and do not communicate with any internal organs.

Most of the gynandromorph crayfishes hitherto known have been females with some male traits.

This case emphasizes the independence of gonad and external sex organ, and is in opposition to internal secretions as a cause of appearance of external sex organs.

Whether such mixtures of sex organs can be due to abnormal fertilizations, to polyspermy, may be decided by future experiments in cross breeding of crayfish. At present the evidence seems to indicate that these gynandromorphs may arise in the ovarian egg.

Organs of Sperm-transfer in Male Crayfish: E. A. ANDREWS, Johns Hopkins University.

Though the sperms of crayfishes appear to be killed by fresh water yet they are transferred by the male to the outside of the female while under water. A comparative study of the reflexes and instincts involved shows the use of three sets of organs in the male that are necessary for the perpetuation of the species. These are the papillæ of the last thoracic limbs and the specialization of the first and the second limbs of the abdomen. In *Cambarus* there are also one or two pairs of hooks upon the thoracic legs.

The anatomy of these structures shows that in *Cambarus* the first abdominal appendage is much more complex and accurately adjusted than had been thought, so that these crayfish are even more highly evolved than they had been considered to be. On the other hand, the like appendage of the crayfish of Japan is not fundamentally as much like that of *Cambarus* as had been thought, but more primitive. This tends to lessen the difficulties of one problem of geographical distribution of crayfish by lessening the resemblance of eastern Asiatic to eastern American forms.

The evolution of the accurately interadjusted male and female organs of sperm-transfer in crayfishes seems to admit of no present scientific explanation.

Pelagic Nemerteans: W. R. Coe, Yale University.

Comparative anatomical studies of numerous species from various parts of the world leave little doubt as to the affinities of these aberrant forms. Recent discoveries of pelagic species show that they are distributed around the whole circumference of the globe, and although they do not appear to be abundant in any locality, the Arctic and Antarctic oceans are the only large bodies of water without known representatives. The structure of the proboscis, the arrangement of the muscular layers of the body, and the disposition of the blood vessels, indicate their origin from more than a single one of the more generalized types of Hoplonemerteans.

The Breeding Habits of the Squid: Gilman A. Drew, University of Maine.

It has long been known that female squid with nearly mature eggs have packages of sperm attached to their outer buccal membrane. This summer Professor E. G. Conklin observed a few packages of sperm on the oviduct of a squid. Observations following this have shown that this is not an uncommon, but, on the other hand, not a universal condition.

The transfer of the sperm to both of these locations has been observed many times during the past summer.

When the sperm is deposited on the oviduct, the male grasps the female around the body just behind the mantle opening, or frequently attaches further back and crawls forward. The dorsal side of the male is usually just below or a little to the left of the ventral side of the female. The male then extends its penis well into its funnel, ejects a bunch of spermatophores, which it catches at the outer opening of the funnel with the end of its left ventral arm. This arm, with the spermatophores, is immediately inserted far into the mantle chamber of the female by the left side of her neck above the funnel, and held there perhaps ten seconds. Its position can sometimes be seen through the transparent mantle of the female. It is then withdrawn, the male releases the female, and a few seconds later the empty cases of the spermatophores escape from the female with the water leaving her funnel. Examination of such a female reveals fresh sperm sacs attached to the oviduct.

The transfer of sperm to the buccal membrane is accomplished while the animals are attached head to head.

The discharge of the spermatophores is similar to *Rossia* as described by Racovitza.

Several females were observed while depositing their eggs. Usually the female rests quietly upon the bottom for several minutes before a string of eggs is to be deposited. In this position she frequently remains until the end of the string protrudes about three quarters of an inch from the funnel. She then begins to swim backward, largely by means of the fin, but partly by water that escapes from the funnel around the egg string. While swimming in this manner, she passes her two dorsal arms between the others and catches the end of the egg string with them and draws it up between the arms as it leaves the funnel. Here it remains for two or three minutes, entirely surrounded by the arms, which are kept nervously moving against each other, while she slowly swims about. Just before sticking the egg string to the bottom, she becomes exceedingly nervous in her actions and frequently goes dancing over the bottom on the tips of her arms with the body perpendicular, in a most sensational manner. Suddenly, while the body is perpendicular, or nearly so, she attaches to the bottom with the ends of her arms, draws down tight against the bottom and then withdraws, leaving the egg string attached.

Molluscan Studies on Lake Champlain: H. F. PERKINS, University of Vermont.

Some Holothurian Structures: CHARLES LINCOLN EDWARDS, Trinity College.

In *Cucumaria frondosa* I have found vestigial anal teeth, well marked in specimens 1–2 mm. long, one developing at the posterior termination of each mid radial line just beyond the bases of the last pair of pedicels and *outside* of the anus. These anal teeth remain small and can be found in a majority of the adult specimens, but are never functional and hence may be regarded as vestigial. In very young *Holothuria floridana* I have found three fan-shaped calcareous plates, two lateral and one posterior, which function somewhat as anal teeth, disappearing in the adult, and they also are vestigial structures.

In *Cucumaria frondosa*, the female has a simple, conical genital papilla, while in the male it is subdivided into three to ten parts. The distal portion of each part bifurcates, a genital pore terminating each branch, while the proximal portions of all parts fuse in the common base. Heretofore subdivided, or multiple, genital papillæ have been known only in a few Elasipoda, but I have seen no record of differentiation in the form of male and female genital papillæ. In one *Thyone* and two *Cucumaria* a genital papilla in the male only has been reported.

The Growth of Parts in the Dogfish: WM. E. KELLICOTT, Woman's College of Baltimore.

The weights of the brain, heart, rectal gland, pancreas, spleen, liver and gonads were determined in a series of 315 dogfish (*Mustelus canis*), including specimens from birth, weighing about 76 grams, up to a maximum observed weight of 8,434 grams.

It was found that these organs did not grow at the same rates nor at the rate of the organism as a whole. These parts, except the gonads, are heaviest, relative to the total weight, at birth or soon thereafter and from this time onward constantly diminish in relative weight.

Since the parts of the organism do not grow similarly, description of its growth by recording total weights does not describe the actual growth processes of the whole organism, but chiefly of some predominating parts—in most vertebrates these are the muscles and connective tissues which make up roughly 75 per cent. of the total weight.

In this indeterminately growing form all the parts mentioned tend to be outgrown by the muscles and supporting tissues; a condition of determinate growth might be derived from this by the action of some mechanism for stopping the growth of these tissues at such a point that the brain and viscera remain competent as physiological elements.

The Criteria of Homology in the Peripheral Nervous System: C. JUDSON HERRICK, University of Chicago.

The synonymy of the peripheral nerves of lower vertebrates is in great confusion. This is largely due to the fact that the exact composition of the various rami (particularly of the cerebral nerves) was formerly imperfectly known, and hence nerves of very diverse composition were often compared on the strength merely of topographic similarities of distribution. With the extension of our knowledge of the nerve components of representative vertebrates, it becomes desirable that a standard method of procedure be established in the determination of homologies and in the selection of names for mixed rami and in other cases in which diversity of usage has arisen. A few rules governing homologies are suggested in the present paper, which will be published in the *Journal of Comparative Neurology and Psychology*.

On a New Species of Goblin Shark (Scapanorhynchus jordani) from Japan: L. HUSSAKOF, American Museum of Natural History.

Scapanorhynchus (*Mitsukurina*) is a rare shark occasionally taken in the deeper waters of Japan. Only one species has hitherto been known, *S. owstoni* Jordan. In the present paper a second species was described, for which the name *S. jordani* was proposed. It differs from *owstoni* in the much lesser protrusibility of the jaw, much smaller spiracle, smaller gill area and the more forward position of the nostril, eye and spiracle.

The proper generic name of this shark was discussed. The fish was originally described by Jordan under the name *Mitsukurina;* but this genus, as has been pointed out by several investigators, is apparently identical with the Cretaceous form *Scapanorhynchus.* The latter name has priority.

Some Features of the Development of Desmognathus fusca: W. A. HILTON, Cornell University.

Tactile Reactions and Polarity in Tentacles of Actinians: H. W. RAND, Harvard University.

The following demonstrations were exhibited:

Specimens of the Partulæ of the Society Islands, Illustrating Distribution and Isolation: H. E. CRAMPTON.

Races of Paramecium and their Relation to Selection and Conjugation: H. S. JENNINGS.

Demonstrations to Illustrate the Modification and Control of Behavior of Characters in Crossing: W. L. Tower.

Photographs Illustrating the Regenerative Power of the Somatic Cells of Sponges after Removal from the Parent: H. V. Wilson.

Specimens of the 900th Generation of Paramecium, Attained without Artificial Stimulation or Conjugation: L. L. Woodruff.

Lorande Loss Woodruff,
Secretary
Yale University

SOCIETIES AND ACADEMIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 453d meeting was held January 23, 1909, with President Palmer in the chair. Several informal notes were presented. Mr. F. E. Matthes offered some notes on snow and winter insects collected in the vicinity of Washington. Among the true snow insects especial interest attaches to *Boreus nivalis* (Neuroptera). This insect is common in the northern states, but has hitherto been considered rare in the District of Columbia. On Christmas day, 1908, and at various times in January, 1909, it was found in abundance in Rock Creek Park. On the date first mentioned, two of this species were observed mating on the snow. On the same day large numbers of winter insects belonging to the Hymenoptera were gathered in the same locality. They represent the winter generation of two Cynipid gall flies, consisting of hermaphroditic individuals, whose larval stages are passed in the roots of oak trees. They oviposit in the young buds of the same tree, thus producing the galls on the leaves in which the summer generation develops. It appears essential, according to observations by Dr. E. A. Schwarz and others, that the ovipositing be done as soon as the buds show the first signs of life in spring. It takes place therefore about the end of February as a rule. In view of this, it seems surprising that the insects should have been found at so early a date as December 25, almost two months prior to the first budding of the leaves.

The difficulties attached to any studies whereby the winter generations of these species might be connected with the corresponding summer generations have thus far proved almost insuperable, and as a consequence no definite correlation exists as yet. For the present the individuals of the winter generation (which look quite unlike the summer generation) are referred to the genus *Andricus*. Both *Andricus* species found have atrophied wings, those of the larger species being apparently perfect but about half the size necessary for flight. They thus possess a characteristic also found in *Boreus*. In the male of the latter, however, the wing remnants are of an imperfect and strangely aberrant type.

Mr. M. B. Waite exhibited a Jonathan apple having a peculiar decay. The specimen represented a lot which had been shipped from Colorado to Los Angeles, California, kept there in cold-storage, and then sent to Washington for diagnosis. Three species of apple rot fungi found in the decayed spots were considered secondary since most of the decayed areas were free from fungi or bacteria. The discolored areas, often in the form of a band around the apple, were firm in texture, light brown in color, and extended to a moderate depth in the flesh of the apple. The cells in the discolored areas were collapsed and ruptured, thus coinciding with frost injury. The damaged area was concluded to be due to freezing, or, since the apple stands freezing, to the peculiar conditions of thawing out after freezing.

Dr. H. M. Smith announced and commented upon the transfer of the administration and personnel of the federal fur-seal service to the Bureau of Fisheries.

Dr. B. W. Evermann reported an observation made by his brother, A. M. Evermann, near Burlington, Indiana, showing that fox squirrels sometimes feed upon the seeds of the cocklebur (*Xanthium strumarium*). The observation was made January 19 when snow covered the ground. The squirrels carried the burr to a log at the edge of a field and there got at the kernels by gnawing away one side.

He also reported the capture of a barn owl in Carroll County, Indiana, in December, 1908. This species had not been previously recorded from that county.

The regular program consisted of the following four papers:

Bee Diseases: E. F. Phillips.

The honey bee, *Apis mellifera*, is subject to several specific diseases which are well recognized among practical bee keepers. The causes of all of them are not fully understood. Two of these attack the bee in its embryonic stages and are now designated American foul brood and European foul brood. They attack the bee just about the time that pupation begins and the colony is depleted because as the adult bees die from natural causes there are not enough bees emerging

to replace them. The cause of American foul brood has by inoculation experiments been determined to be *Bacillus larvæ*. This organism grows well only on a medium prepared by mashing healthy bee larvæ and sterilizing by filtration. Fifteen minutes of boiling is required to kill the spores of the bacillus. The cause of European foul brood is not known. There are other maladies of the brood and of the adult bee. The methods of treatment and means of spread were discussed.

Federal Control of Fisheries in International Waters: B. W. EVERMANN.

He discussed briefly the questions of federal control of migratory birds, of migrating fishes, of inter-state waters and of international waters. Attention was called to the valuable work which the Hon. George Shiras, III., has done, and is still doing, in calling attention to the power of the government in matters such as these which experience has demonstrated can not be properly handled by the respective states. When a member of Congress Mr. Shiras introduced two or three bills providing for federal control of migratory birds and fishes, and one providing for federal control of inter-state waters.

On April 11, 1908, a convention was entered into between the United States and Great Britain according to the terms of which uniform regulations will be provided governing the fisheries on the United States and Canadian sides of our northern boundary. The special International Fisheries Commission appointed under the treaty is now drawing up its report which must be submitted to the respective governments by June 3.

This report, it is understood, will contain a complete system of regulations for the fisheries in all international waters between the United States and Canada.

A Remarkable Flight of Bats in Luzon: HUGH M. SMITH.

He presented notes on a remarkable flight of small bats observed by him near Montalban, Luzon, P. I., on December 31, 1907. At 5.40 P.M. a solid column of bats began to emerge from a large cave about 1,200 feet above the Mariquina River. The bats flew rapidly in a straight, unbroken, closely-packed line for fifteen minutes, and disappeared over a mountain range in the direction of Manila without a single bat having left the column. American engineers at the place reported that this flight had occurred at practically the same time each day during the two years they had been there; and from other sources it was learned that the same thing had been observed for at least thirty years.

A Visit to the Bat Cave in Luzon: PAUL BARTSCH.

He described the cave from which came the flight of bats referred to by the preceding speaker. The cave is a large one. Its main entrance is about 35 feet high and 25 feet wide, and difficult of access. A short passage connects the entrance with the central dome which has a diameter of about 150 feet and height of about 200 feet and perforates the mountain top. From this chamber passages open in various directions, frequently expanding into large rooms, some of which have wonderful stalagmites and stalactites, while others are simply glazed with a glistening lime deposit. An hour and a half was spent going from chamber to chamber and the native guide stated that he might continue for half a day without retracing his steps. Bats of several species were seen flitting about or clinging to the wall of the cave everywhere, but not enough to make a hundredth part of the swarm seen on the night of the last of December, 1907. Owing to the failure of the bat flight the previous night (July 4, 1908) the party had expected to find dead bats in the cave, believing that some epidemic might have killed them. This seemed the probable solution since on their previous visit the party had been assured that the bats had never been known to fail to make their appearance at a certain hour for many years. Careful search of the floor which was richly covered with guano, failed to reveal any dead individuals, and the whereabouts of the immense flight remains a mystery at present.

M. C. MARSH,
Recording Secretary

THE CHEMICAL SOCIETY OF WASHINGTON

THE 188th meeting of the Washington Chemical Society was held at the Cosmos Club on Thursday, February 11, 1909, at 8 P.M. President Walker presided, the attendance being 62. Eleven new members were added to the roll and two resignations were announced. J. M. Bell, of the Bureau of Soils, was appointed chairman of the committee on communications and M. X. Sullivan, of the Bureau of Soils, chairman of the entertainment committee. Arrangements were announced to hold the annual smoker at the Riggs House on Thursday, February 18. The following papers were presented:

"The Formation of Gluconic Acid by the Olive Tubercle Organism and its Physiological Function," by C. L. Alsberg.

"The Chemical Constituents of Oil of Erigeron and Wild Sage," by Frank Rabak.

"China Wood Oil," by E. W. Boughton.

J. A. Le Clerc,
Secretary

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

At the 428th regular meeting of the Society, held at the Cosmos Club February 2, 1909, the following program was presented:

A Newly Discovered Siouan Dialect: Dr. John R. Swanton.

Dr. Swanton visited the small remnant of Tunica Indians living close to Marksville, La., in November, 1908, for the purpose of correcting and amplifying the linguistic material recorded by Dr. Gatschet over twenty years ago. In the course of his investigations he had the good fortune to find a single survivor of an Indian tribe formerly living on the Yazoo River and known from French accounts as Offogoula. A sufficient vocabulary was obtained to show that the language spoken by them was not Muskhogean, as had hitherto been supposed, but a Siouan dialect related to those of the Biloxi and the eastern Siouan tribes. It is peculiar in substituting f for s in many situations and tc for y in others. The proper name of the tribe is Ofo, and probably has nothing to do with Choctaw ofe, "dog," as has hitherto been supposed.

Exhibition of Ethnographic Specimens by Members of the Society.

Dr. I. M. Casanowicz exhibited a silver lamp with eight burners used by the Jews in the Hanuga ceremony, the origin of which was explained at some length. This lamp is the property of Ephraim Benguiat, of New York. Dr. Casanowicz also showed a design representing a globe made of the book of Ecclesiastes in Hebrew characters in a single line.

Mr. Edwin P. Upham, of the Smithsonian Institution, exhibited and gave the place of origin of a series of stone scrapers and a series of stone axes. A general examination and discussion followed on the part of the members of the society.

John R. Swanton,
Secretary

THE BIOLOGICAL AND GEOLOGICAL SECTION OF THE ACADEMY OF SCIENCE AND ART OF PITTSBURG

At a regular meeting of the section on February 2, Mr. F. G. Clapp spoke on the "Influence of Geological Structure on the Occurrence of Oil and Gas." Mr. Clapp briefly discussed the "anticlinal theory" of White and Orton and indicated the other factors which must always be considered in connection with it in order to make determinations of practical value. The following generalizations were made in regard to the fields of southwestern Pennsylvania and northern West Virginia:

1. All conditions being favorable, the accumulations of oil and gas do show a definite relation to the geologic structure.

2. With but few exceptions the greatest elongation of the pools is approximately parallel to the axes of the folds.

3. When both oil and gas are present in a stratum of sandstone, they are distributed according to their densities, the oil in the lower and the gas in the higher portion of the layer.

4. When oil and salt water are present the oil generally occurs in the part of the stratum lying directly above the water level.

5. When salt water is absent the oil may occur at the bottom of the syncline, or may be part way up the anticlinal slope.

6. Oil may occur on a "structural bench," where the dip of a stratum changes from gentle to steep.

7. Gas occurs mainly near the crests of anticlinal folds.

8. It occurs, however, in greatest volume in certain portions of the anticlinal crests which take the form of structural "domes."

9. Gas occurs in volume also at many widely scattered points, due to local changes in the dip and texture of the rocks.

The unconformity at the base of the Pottsville formation was briefly described, and the statement made that in certain fields it has a decided influence on the relation existing between the position of the oil and gas deposits and the geological structure as determined by the surface rocks. In general the interval between the surface rocks and the deeper oil and gas "sands" diminishes toward the north and west, and this change frequently shifts the axes of the anticlines and synclines in the deeper sands a fraction of a mile from the position of the same axes in the surface formations. Other changes in the intervals between the various sands must be taken into account in locating oil or gas deposits.

Percy E. Raymond,
Secretary